# Assignment 5: Data Visualization

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## OVERVIEW

This exercise accompanies the lessons in Environmental Data Analytics on Data Visualization

### Directions

1. Change "Student Name" on line 3 (above) with your name.
2. Work through the steps, **creating code and output** that fulfill each instruction.
3. Be sure to **answer the questions** in this assignment document.
4. When you have completed the assignment, **Knit** the text and code into a single PDF file.
5. After Knitting, submit the completed exercise (PDF file) to the dropbox in Sakai. Add your last name into the file name (e.g., "Fay_A05_DataVisualization.Rmd") prior to submission.

The completed exercise is due on Monday, February 14 at 7:00 pm.

### Set up your session

1. Set up your session. Verify your working directory and load the tidyverse and cowplot packages. Upload the NTL-LTER processed data files for nutrients and chemistry/physics for Peter and Paul Lakes (use the tidy [`NTL-LTER_Lake_Chemistry_Nutrients_PeterPaul_Processed.csv`] version) and the processed data file for the Niwot Ridge litter dataset (use the [`NEON_NIWO_Litter_mass_trap_Processed.csv`] version).

2. Make sure R is reading dates as date format; if not change the format to date.

```
#1

getwd()
```

```
## [1] "/Users/rorymccollum/Desktop/Rdata/Environmental_Data_Analytics_2022/Assignments"
```

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.6     v dplyr   1.0.7
## v tidyr   1.1.4     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(cowplot)
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
```

```
## The following object is masked from 'package:cowplot':
##
##     stamp
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
PeterPaul.chem.nutrients <- read.csv(
  "/Users/rorymccollum/Desktop/Rdata/Environmental_Data_Analytics_2022/Data/Processed/NTL-LTER_Lake_Chem
  stringsAsFactors = TRUE)

Niwot.litter <- read.csv(
  "/Users/rorymccollum/Desktop/Rdata/Environmental_Data_Analytics_2022/Data/Processed/NEON_NIWO_Litter_m
  stringsAsFactors = TRUE)

#2

class(PeterPaul.chem.nutrients$sampledate)
```

```
## [1] "factor"
```

```
PeterPaul.chem.nutrients$sampledate<-ymd(PeterPaul.chem.nutrients$sampledate)
class(PeterPaul.chem.nutrients$sampledate)
```

```
## [1] "Date"
```

```
class(Niwot.litter$collectDate)
```

```
## [1] "factor"
```

```
Niwot.litter$collectDate<-ymd(Niwot.litter$collectDate)
class(Niwot.litter$collectDate)
```

```
## [1] "Date"
```

## Define your theme

3. Build a theme and set it as your default theme.

```
#3

rorystheme<-theme_classic(base_size = 14) +
  theme(axis.text = element_text(color = "black"),
        panel.background = element_rect(fill = "blanchedalmond"),
        legend.position = "right")

theme_set(rorystheme)
```

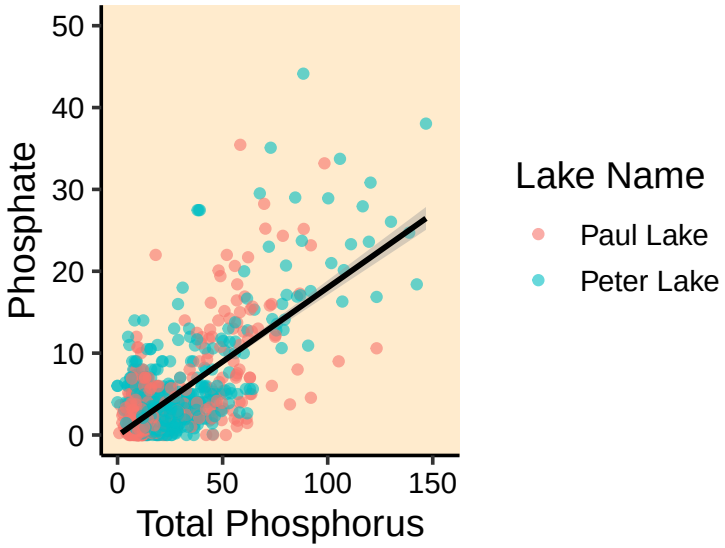
## Create graphs

For numbers 4-7, create ggplot graphs and adjust aesthetics to follow best practices for data visualization. Ensure your theme, color palettes, axes, and additional aesthetics are edited accordingly.

4. [NTL-LTER] Plot total phosphorus (`tp_ug`) by phosphate (`po4`), with separate aesthetics for Peter and Paul lakes. Add a line of best fit and color it black. Adjust your axes to hide extreme values (hint: change the limits using `xlim()` and `ylim()`).

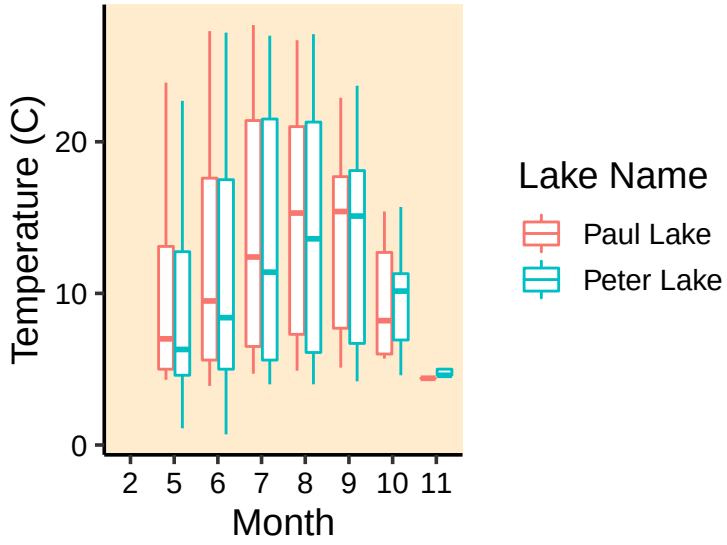
```
#4

phorus_by_phate<-ggplot(PeterPaul.chem.nutrients, aes(x=tp_ug, y=po4, color=lakename))+
   xlim(0,155)+ ylim(0, 50)+
  xlab("Total Phosphorus") + ylab("Phosphate")+
  labs(color="Lake Name")+
  geom_point(alpha=0.6)+
  geom_smooth(method = lm, color="black")

print(phorus_by_phate)
```

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

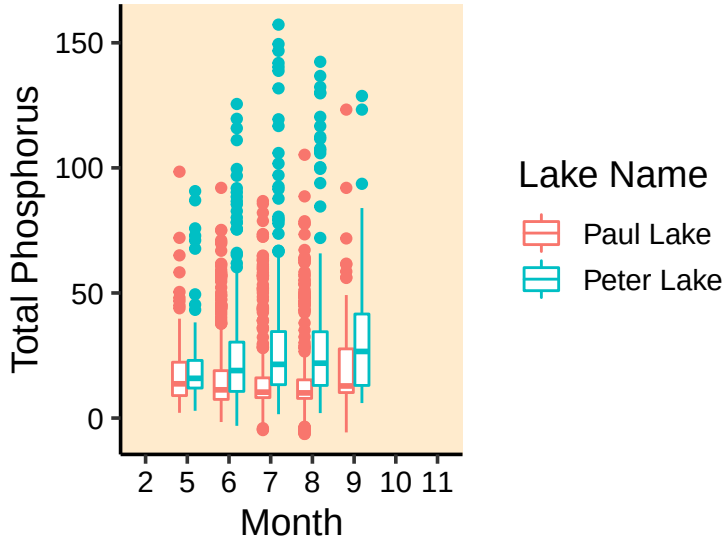



5. [NTL-LTER] Make three separate boxplots of (a) temperature, (b) TP, and (c) TN, with month as the x axis and lake as a color aesthetic. Then, create a cowplot that combines the three graphs. Make sure that only one legend is present and that graph axes are aligned.

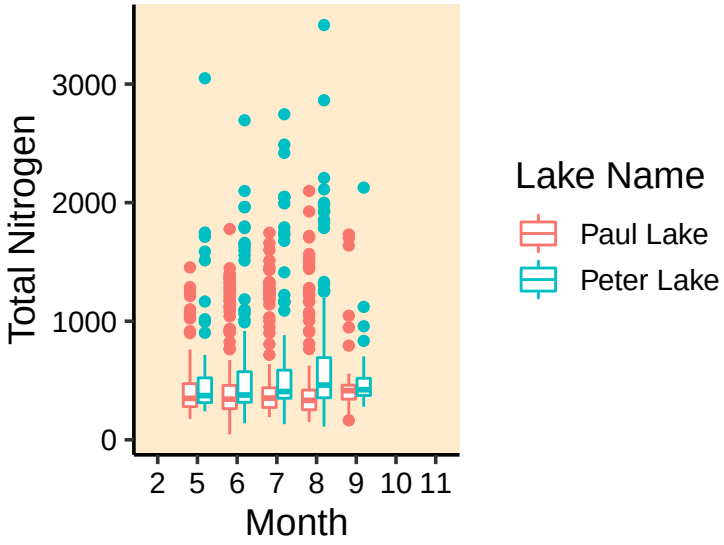
```
#5

#force month to be factor instead of numeric

month1<-as.factor(PeterPaul.chem.nutrients$month)


#Temperature
temp<-ggplot(PeterPaul.chem.nutrients)+
  geom_boxplot(aes(x=month1, y=temperature_C, color=lakename))+
  ylab("Temperature (C)") + xlab("Month")+
  labs(color="Lake Name")

print(temp)
```




```
#TP
TP<-ggplot(PeterPaul.chem.nutrients)+
  geom_boxplot(aes(x=month1, y=tp_ug, color=lakename))+
  ylab("Total Phosphorus") + xlab("Month")+
  labs(color="Lake Name")

print(TP)
```

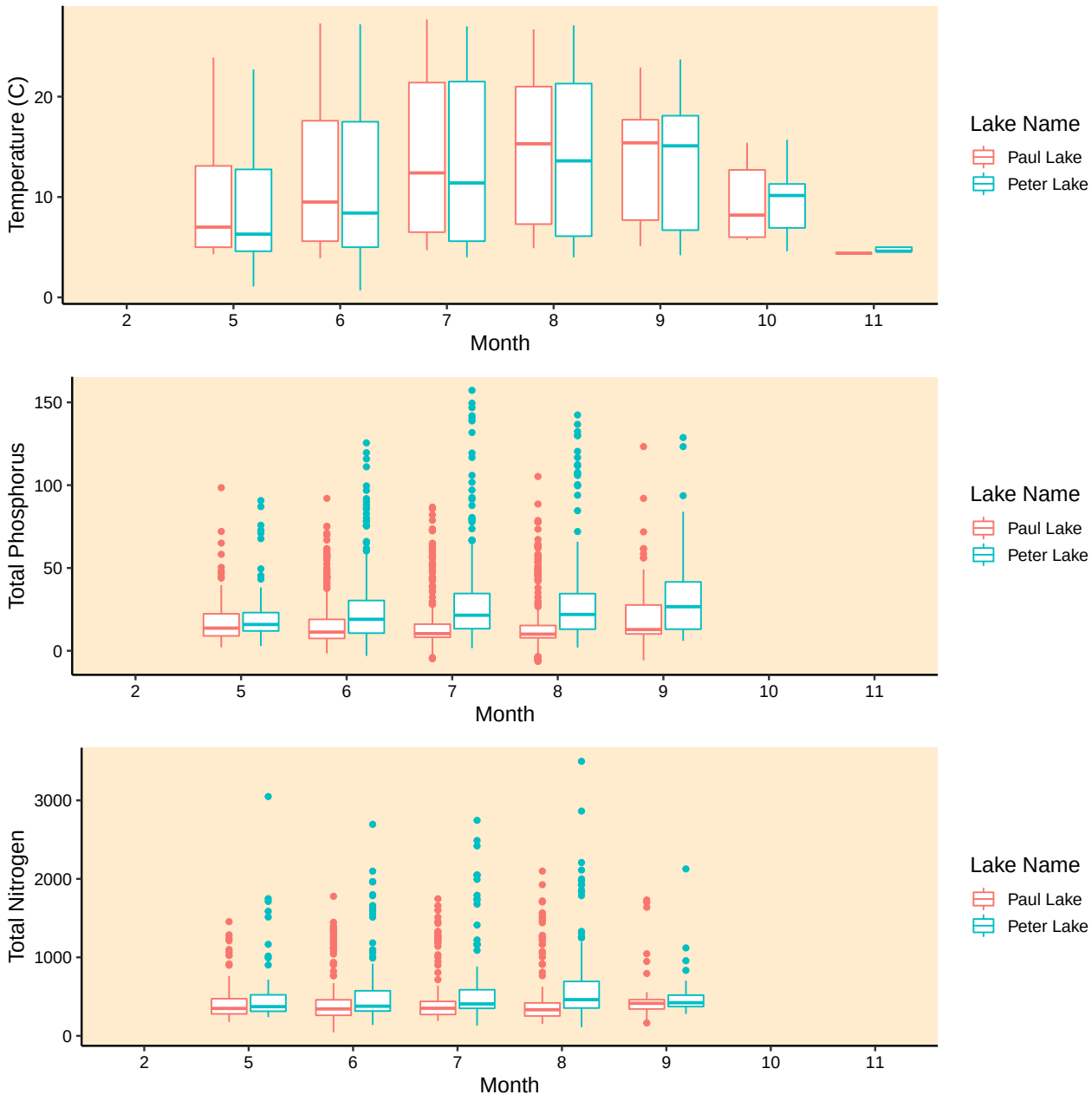



```
#TN
TN<-ggplot(PeterPaul.chem.nutrients)+
  geom_boxplot(aes(x=month1, y=tn_ug, color=lakename))+
  ylab("Total Nitrogen") + xlab("Month")+
  labs(color="Lake Name")

print(TN)
```

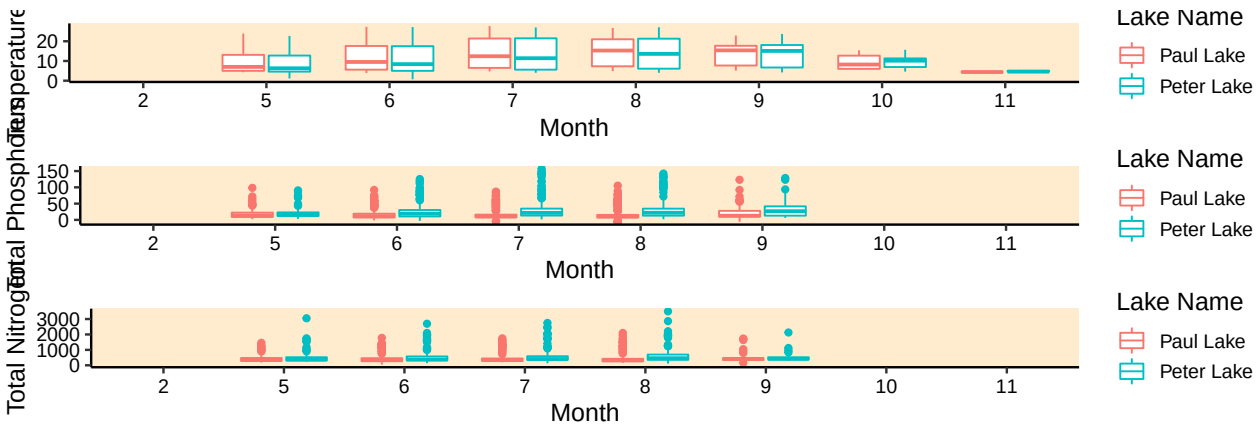



labs(color="Lake Name")

```
#all together

ntlall<-plot_grid(temp, TP, TN, nrow = 3, align = 'h', rel_heights = c(1, 1, 1))
print(ntlall)
```




```
legend<-get_legend(temp)

ntlall.legend<-plot_grid(ntlall, legend, nrow = 3, align='h', rel_heights = 3, 0.3)
print(ntlall.legend)
```





```
#I am aware this did not work but alas
```

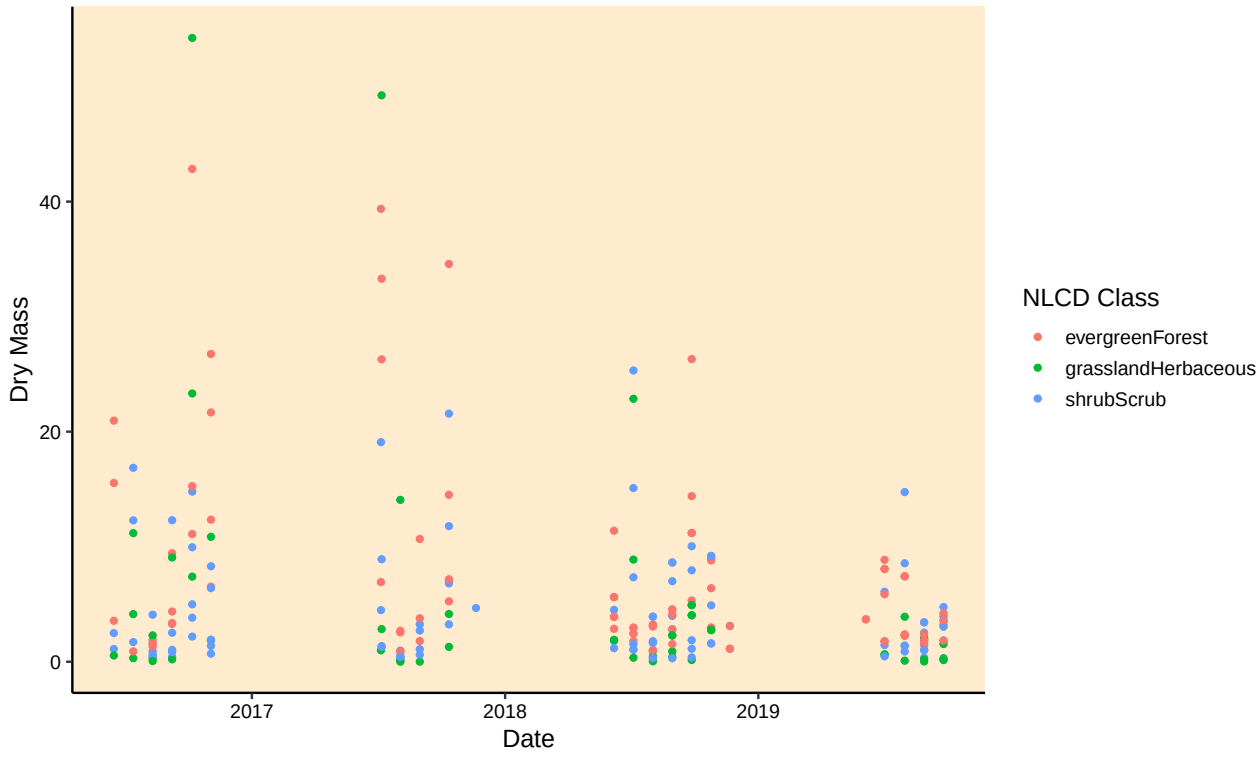
Question: What do you observe about the variables of interest over seasons and between lakes?

> Answer: The temperature varies similarly across both lakes, and as you would expect with the months, getting warmer around June-Aug and cooling down on either side. Phosphorus and nitrogen don't vary much throughout the year in each lake, in general Peter lake has higher amounts of total nitrogen and phosphorus.

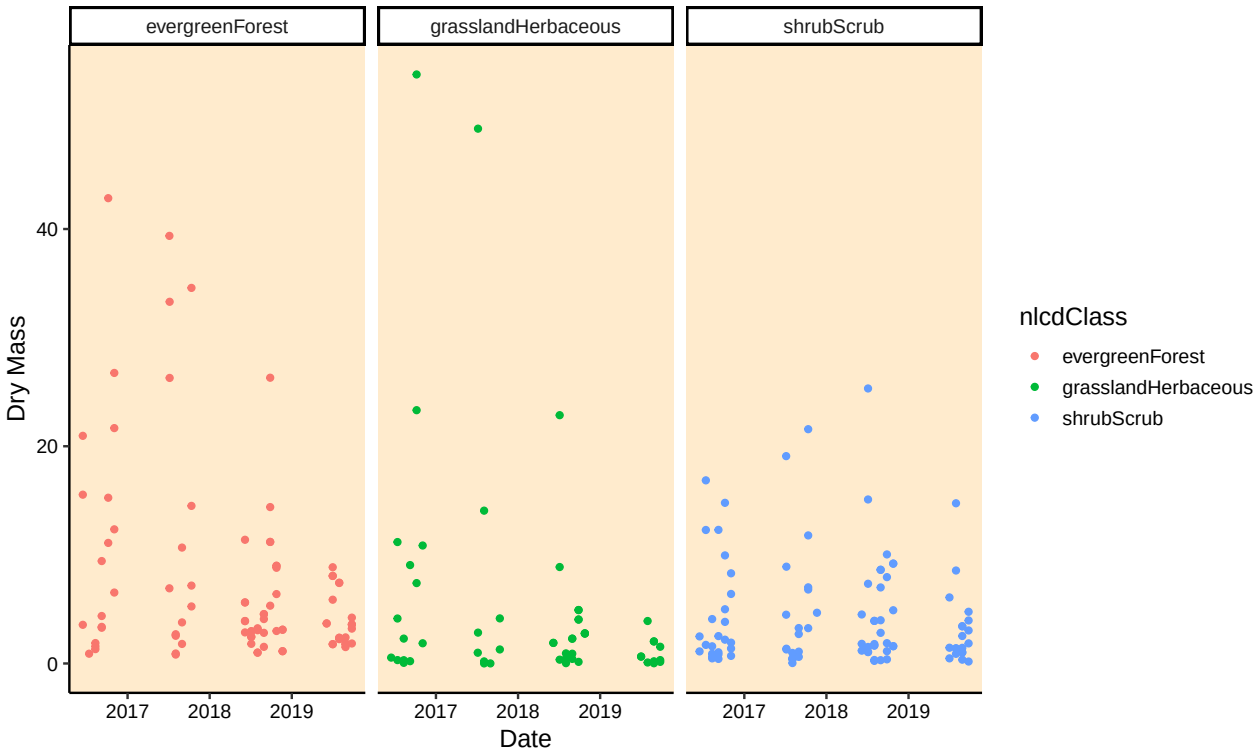
6. [Niwot Ridge] Plot a subset of the litter dataset by displaying only the "Needles" functional group. Plot the dry mass of needle litter by date and separate by NLCD class with a color aesthetic. (no need to adjust the name of each land use)

7. [Niwot Ridge] Now, plot the same plot but with NLCD classes separated into three facets rather than separated by color.

```
#6

drymass_needles<-ggplot(filter(Niwot.litter, functionalGroup=="Needles"))+
  geom_point(aes(x=collectDate, y=dryMass, color=nlcdClass))+
  xlab("Date")+ ylab("Dry Mass")+
  labs(color="NLCD Class")

print(drymass_needles)
```




```
#7
needlesfaceted<-ggplot(filter(Niwot.litter, functionalGroup=="Needles"))+
  geom_point(aes(x=collectDate, y=dryMass, color=nlcdClass))+
  xlab("Date")+ ylab("Dry Mass")+
  facet_wrap(vars(nlcdClass))+
  labs()

print(needlesfaceted)
```




Question: Which of these plots (6 vs. 7) do you think is more effective, and why?

Answer: I think that 7 is more effective because it's easier to differentiate between each land use.