

# Homework6-DV-baseplot

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**First: import libraries, set your working directory, and read in grouse\_data.txt**

```
library(tidyverse)
library(ggforce)
library(ggsci)
library(patchwork)
library(Hmisc)
setwd('~\\Desktop\\PB-HomeworkClub') #change to match your plot directory
grouse_data <- read.delim("grouse_data.txt", header=FALSE, sep=" ")
dim(grouse_data)

## [1] 140 7

head(grouse_data)

##          V1  V2   V3   V4 V5      V6      V7
## 1 aln_CO_HC_27 CO_HC 40.09796 -116.4594 CO -2.331310 1.3060121
## 2 aln_CO_HC_31 CO_HC 40.09796 -116.4594 CO -7.611187 -0.5887571
## 3 aln_CO_HC_32 CO_HC 40.09796 -116.4594 CO -5.631051 4.2827658
## 4 aln_CO_HC_41 CO_HC 40.09796 -116.4594 CO -7.343503 1.9035742
## 5 aln_CO_HC_42 CO_HC 40.09796 -116.4594 CO -9.660262 2.0466814
## 6 aln_CO_HC_48 CO_HC 40.09796 -116.4594 CO -3.628267 5.7411205

## column 1 = individual id
## column 2 = lek name
## column 3 = latitude
## column 4 = longitude
## column 5 = lek complex name
## column 6 = principal component 1
## column 7 = principal component 2

#plot 1.1
## make new matrix for maps (lek, complex, lat, long)

unique_leks <- unique(grouse_data[,2])

map_mat <- matrix(0, length(unique_leks), 4)

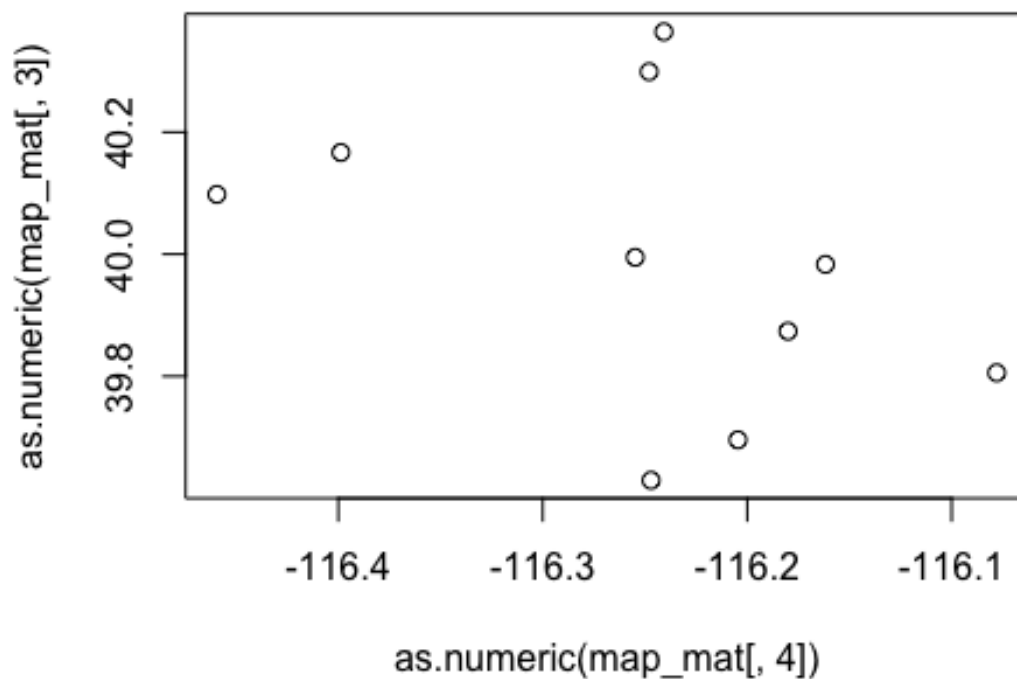
for (i in 1:length(unique_leks))
{
  sub_data <- subset(grouse_data, grouse_data[,2]==unique_leks[i])
  map_mat[i,1] <- unique_leks[i]
```

```
map_mat[i,2] <- sub_data[1,5]  
map_mat[i,3] <- sub_data[1,3]  
map_mat[i,4] <- sub_data[1,4]  
}
```

*## make a very basic map*

*## v0.1: basic*

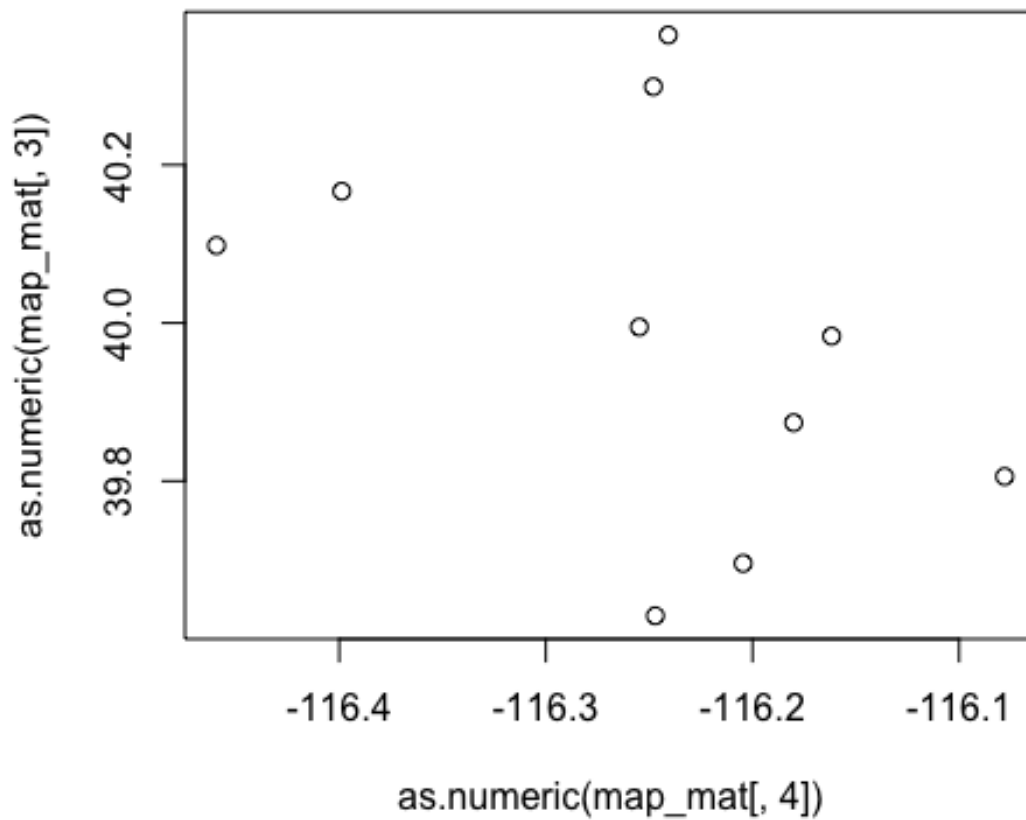
```
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]))
```



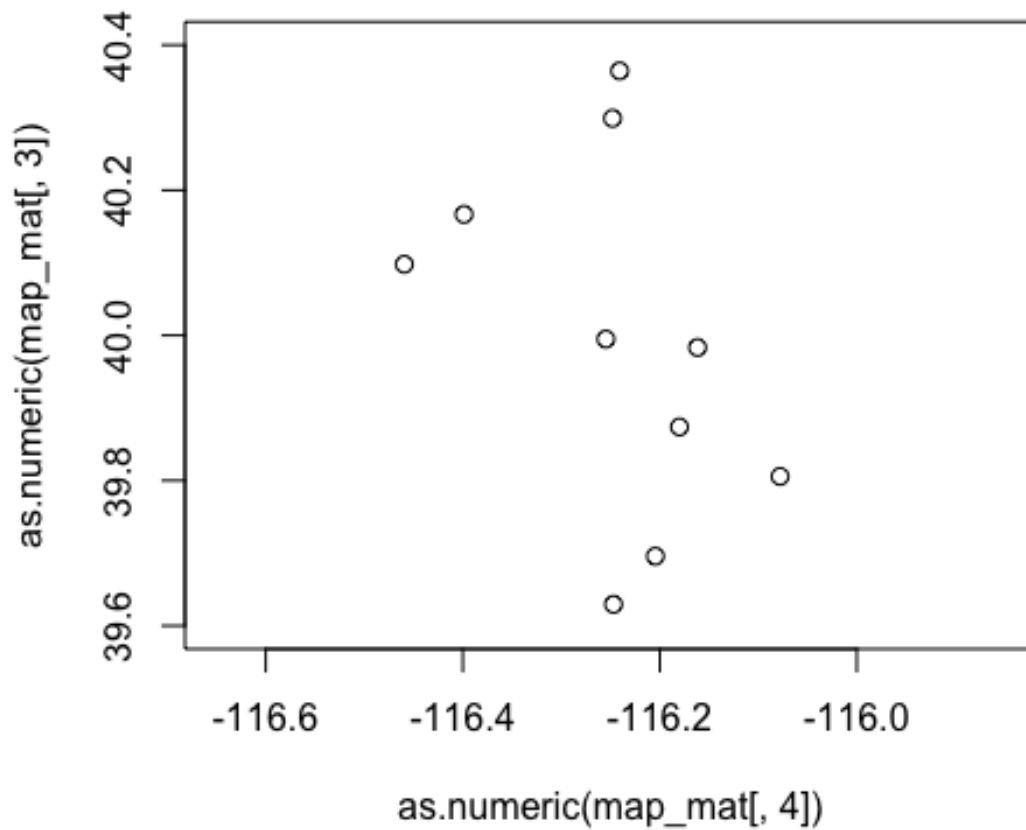
*## v0.2: add graphical parameter formatting using par*

```
par(mar=c(5,5,1,1))
```

```
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]))
```



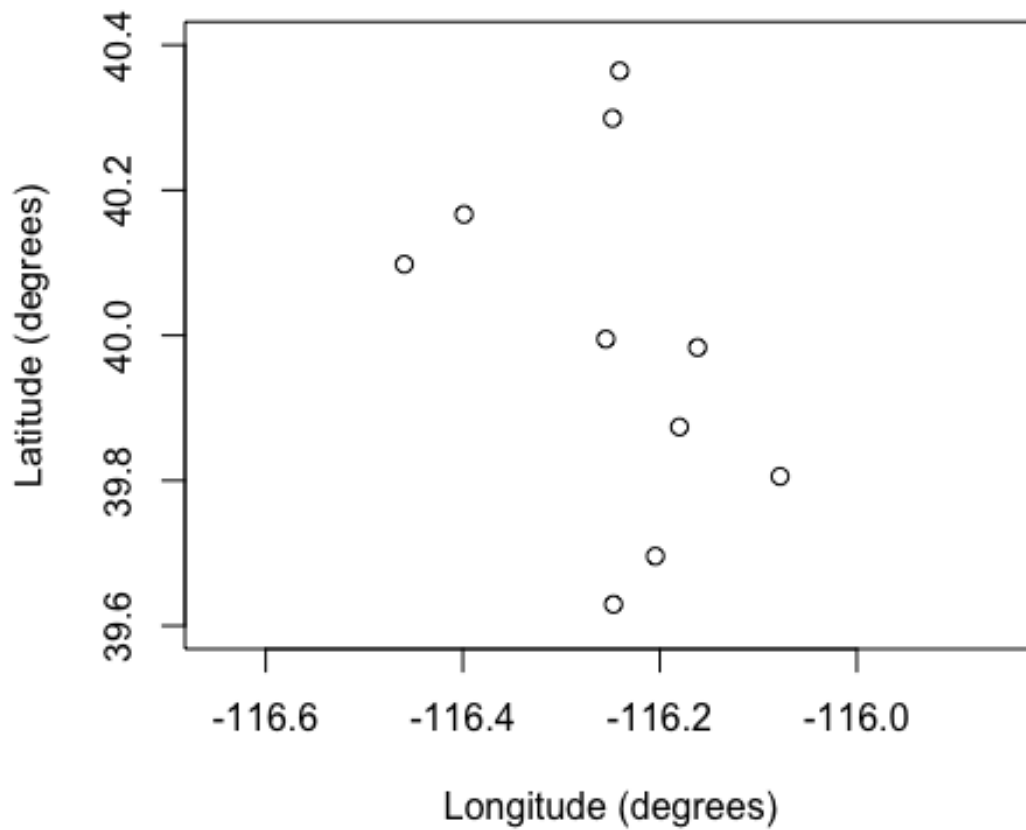
```
## v0.3: standardize x and y limits (need to be equal to one another)
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), ylim=c(39.6, 40.4),
xlim=c(-116.65, -115.85))
```



```
## v0.4: add axis labels
```

```
par(mar=c(5,5,1,1))
```

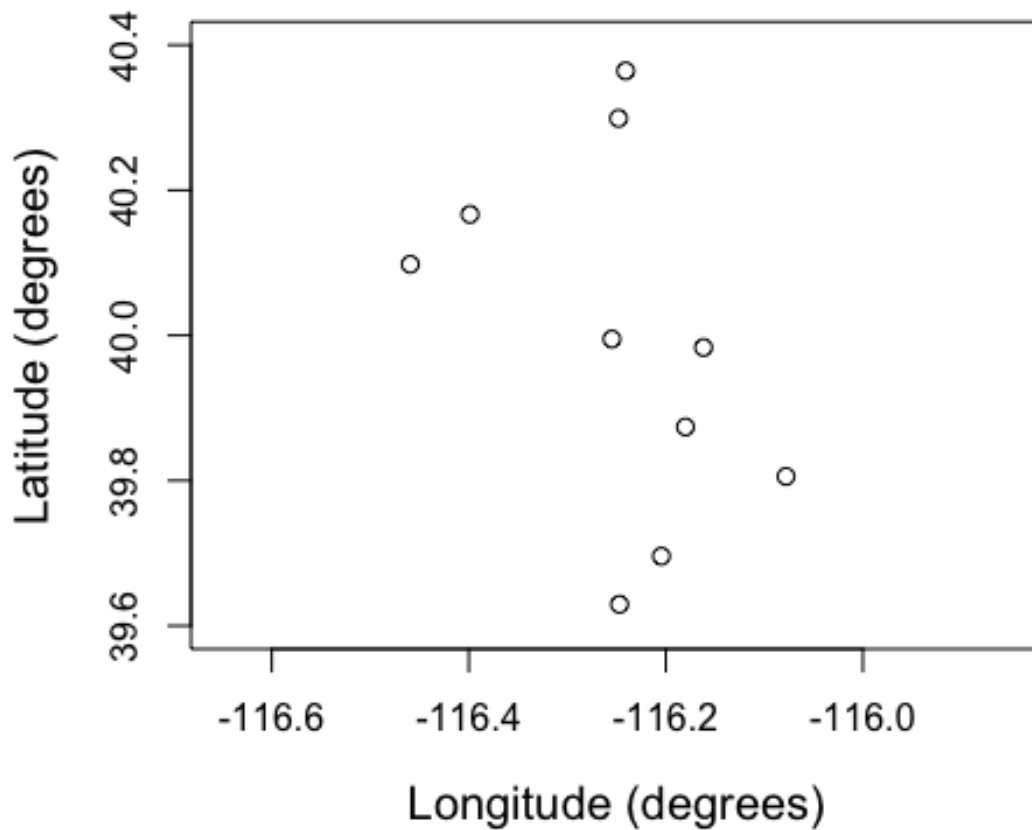
```
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), ylim=c(39.6, 40.4),  
xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude (degrees)")
```



*## v0.5: make axis labels larger*

```
par(mar=c(5,5,1,1))
```

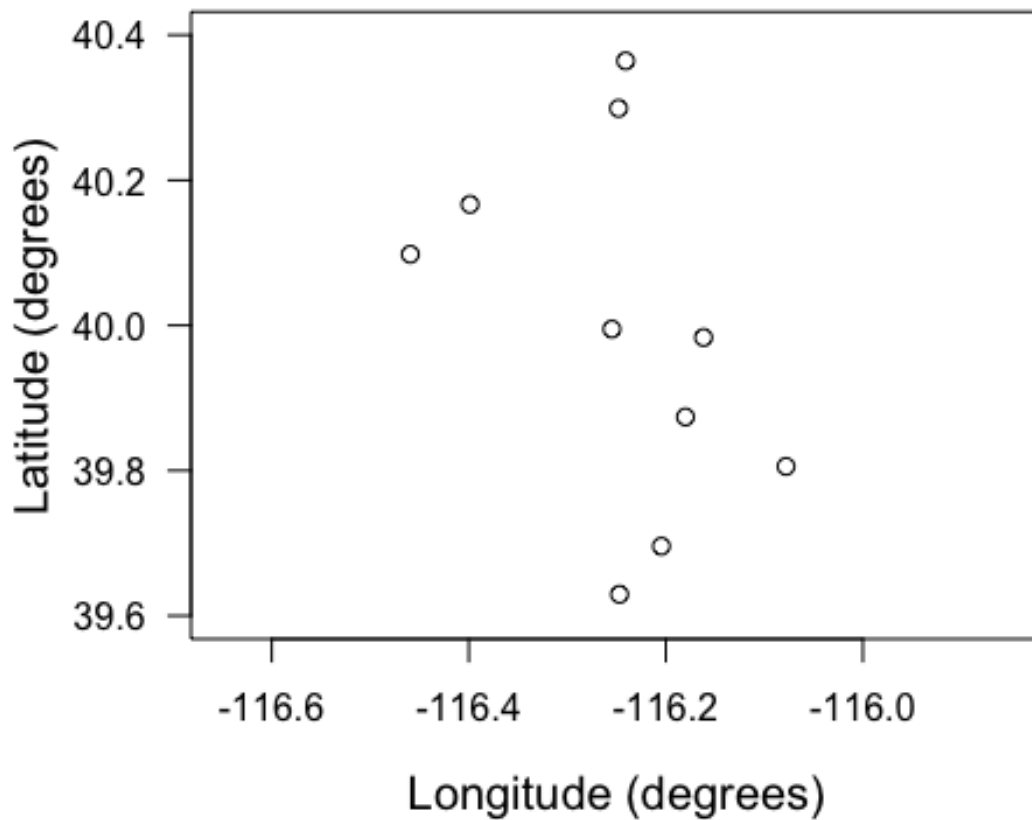
```
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), ylim=c(39.6, 40.4),  
xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude (degrees)",  
cex.lab=1.25)
```



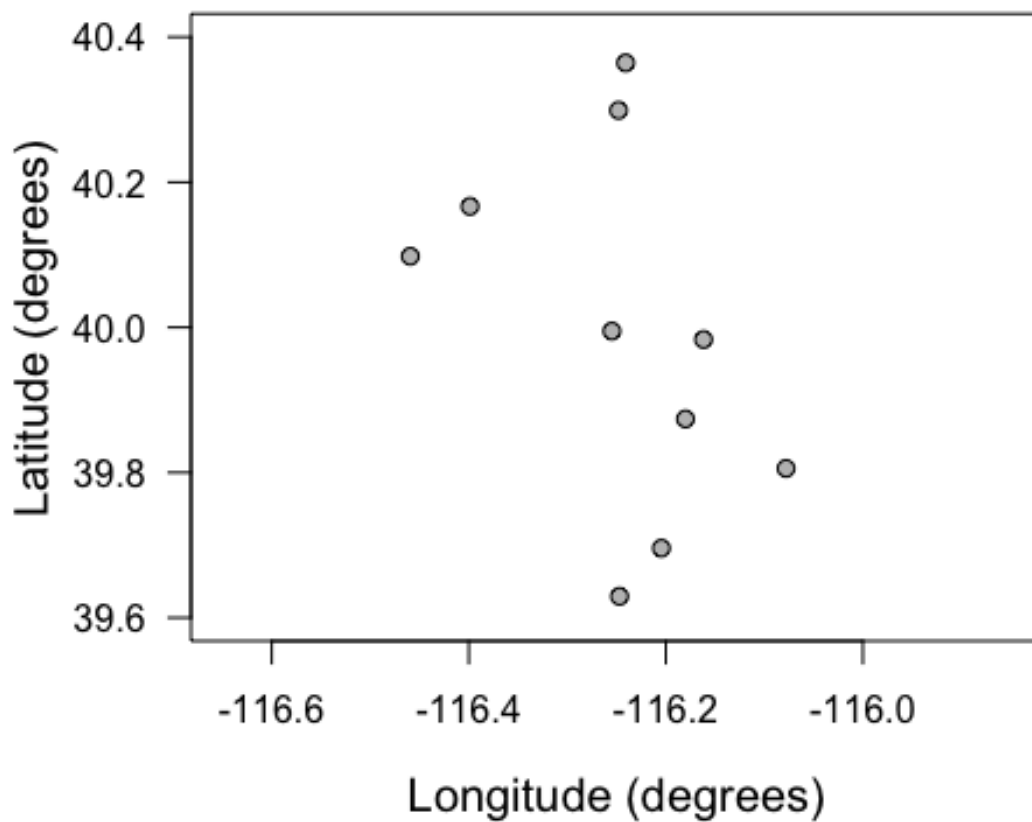
```
## v0.6: rotate y axis labels
```

```
par(mar=c(5,5,1,1))
```

```
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), ylim=c(39.6, 40.4),  
xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude (degrees)",  
cex.lab=1.25, las=1)
```



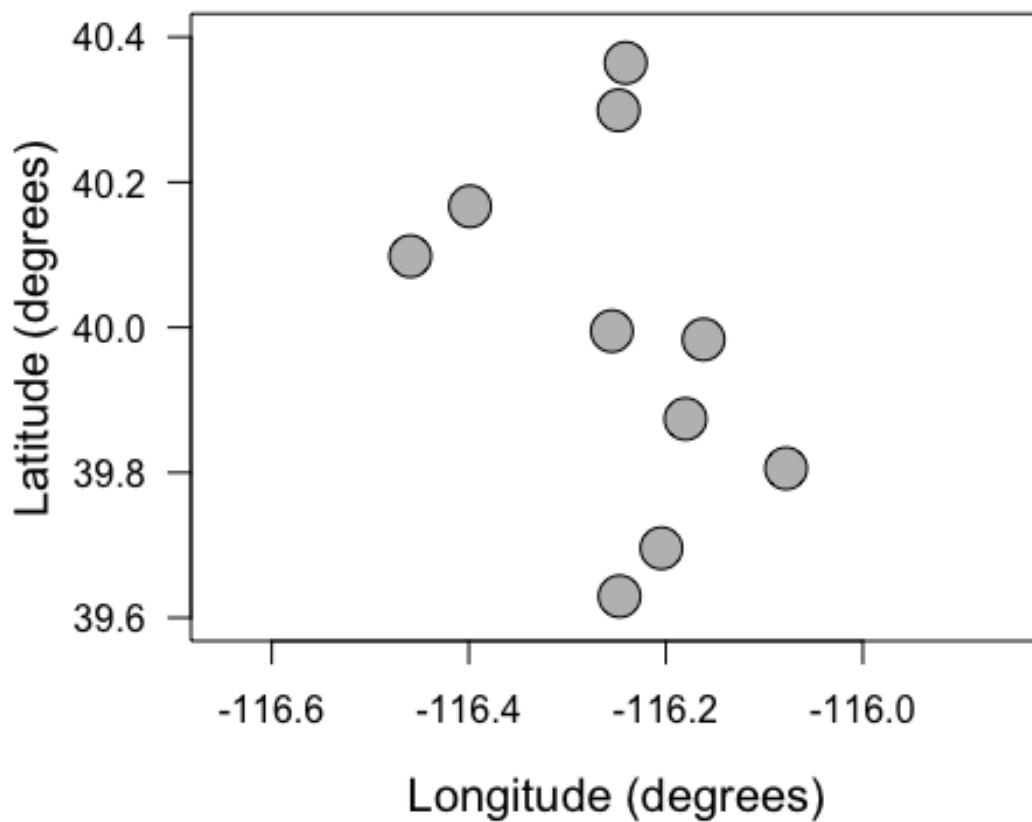
```
## v0.7: fill in points (white points are lame, gray are great)
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), ylim=c(39.6, 40.4),
     xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude (degrees)",
     cex.lab=1.25, las=1, pch=21, bg="gray")
```



*## v0.8: make points bigger*

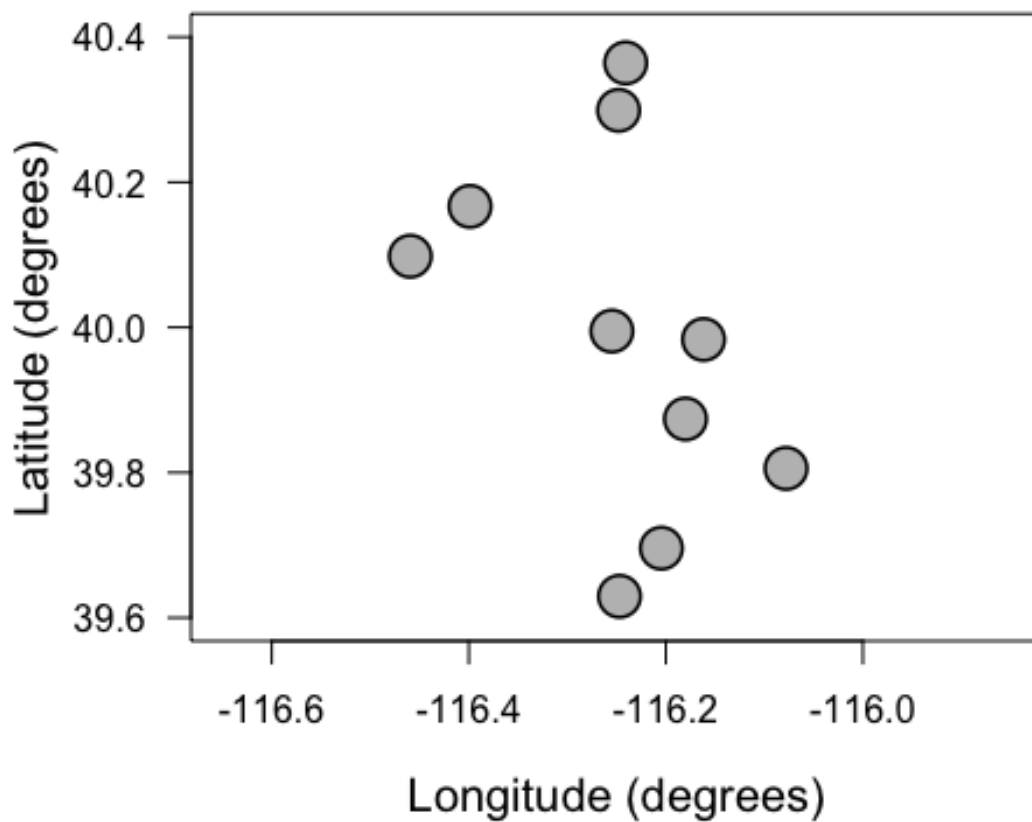
```
par(mar=c(5,5,1,1))  
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), ylim=c(39.6, 40.4),  
      xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude (degrees)",  
      cex.lab=1.25, las=1, pch=21, bg="gray", cex=2.5)
```





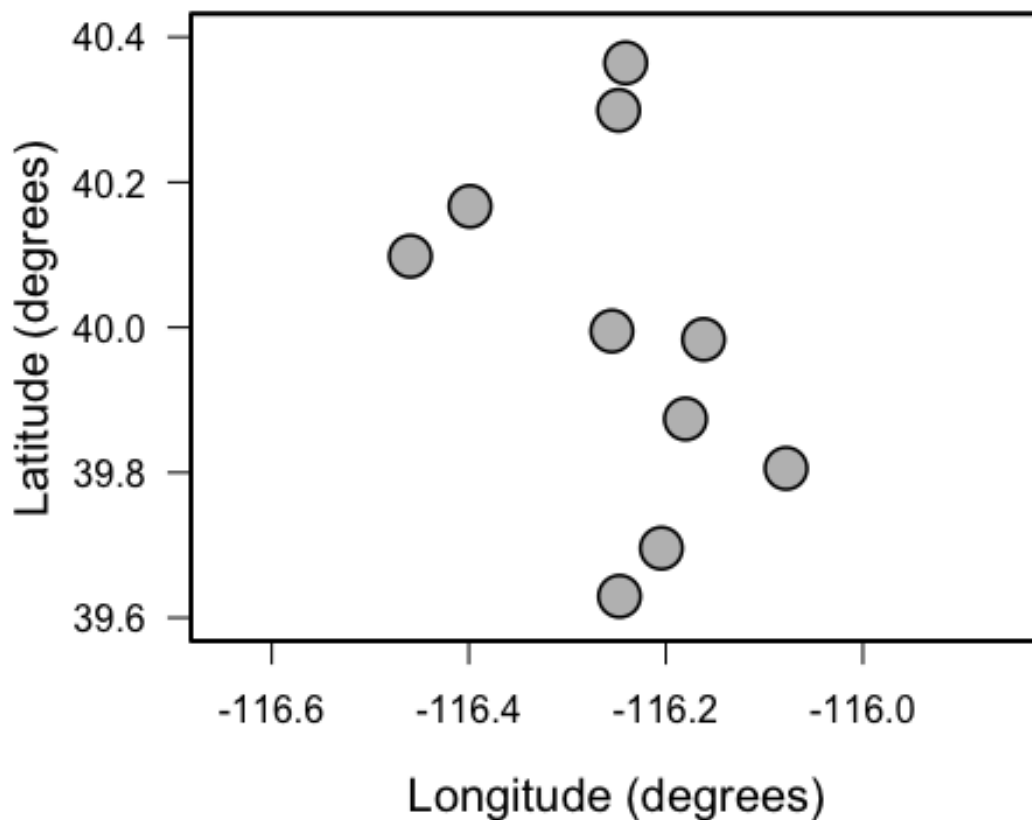
*## v0.9: make points line widths thicker*

```
par(mar=c(5,5,1,1))  
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), ylim=c(39.6, 40.4),  
      xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude (degrees)",  
      cex.lab=1.25, las=1, pch=21, bg="gray", cex=2.5, lwd=1.5)
```



*## v0.10: make plot box line thicker*

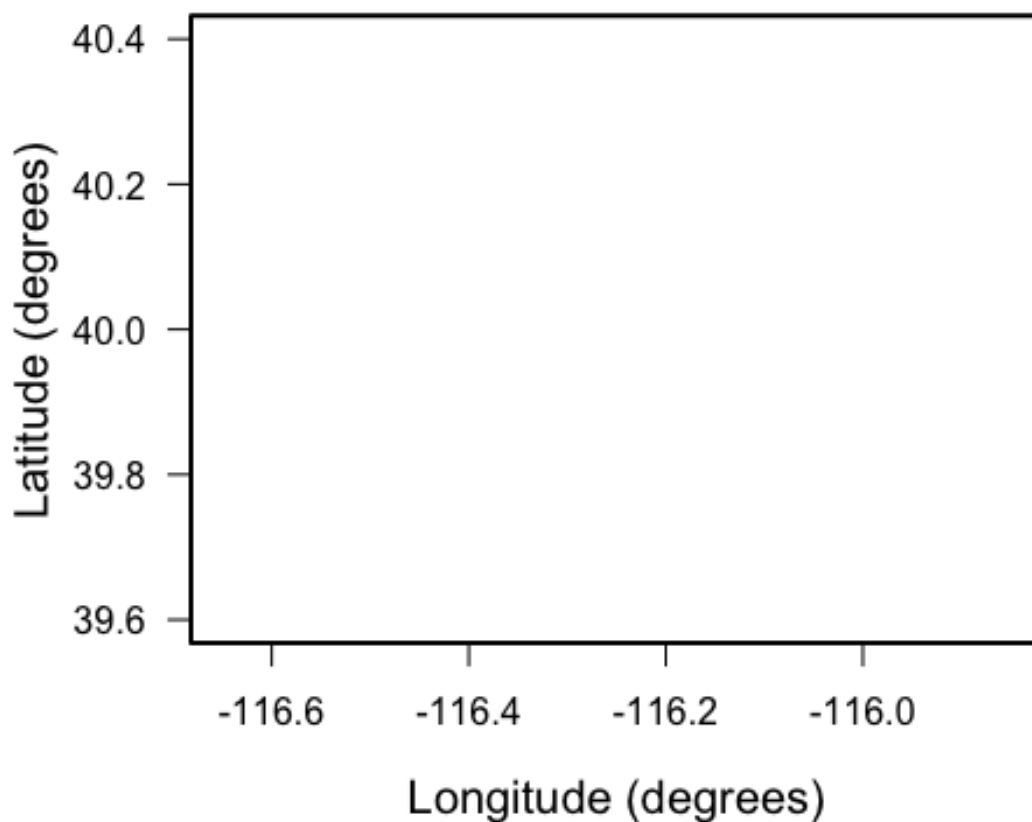
```
par(mar=c(5,5,1,1))  
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), ylim=c(39.6, 40.4),  
xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude (degrees)",  
cex.lab=1.25, las=1, pch=21, bg="gray", cex=2.5, lwd=1.5); box(lwd=2)
```



*## make a map with colors and shape*

*## v1.1: start with an empty plot (type=n), with all of the fun formatting from the basic plot*

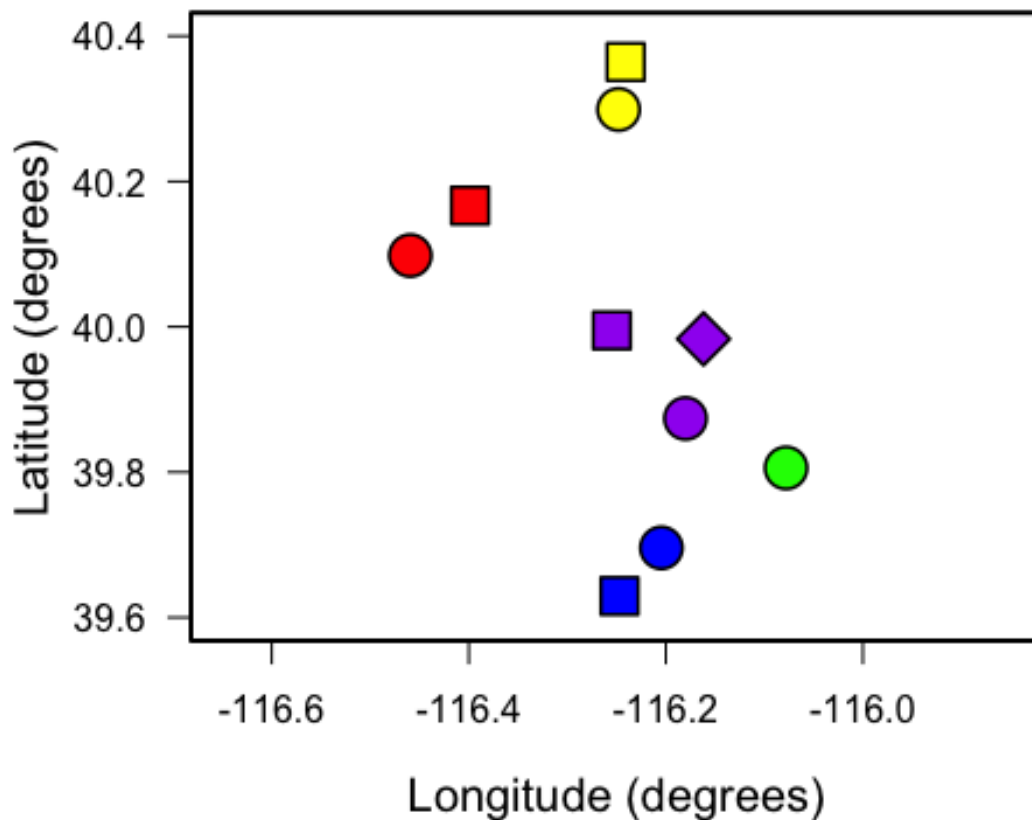
```
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
```



*## v1.2: add points with colors and shapes (colors match lek complex designations)*

```
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21, bg="red",
cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22, bg="red",
cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21, bg="blue",
cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22, bg="blue",
cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="yellow", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="yellow", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21, bg="green",
cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="purple", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="purple", cex=2.5, lwd=1.5)
```

```
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="purple", cex=2.5, lwd=1.5)
```



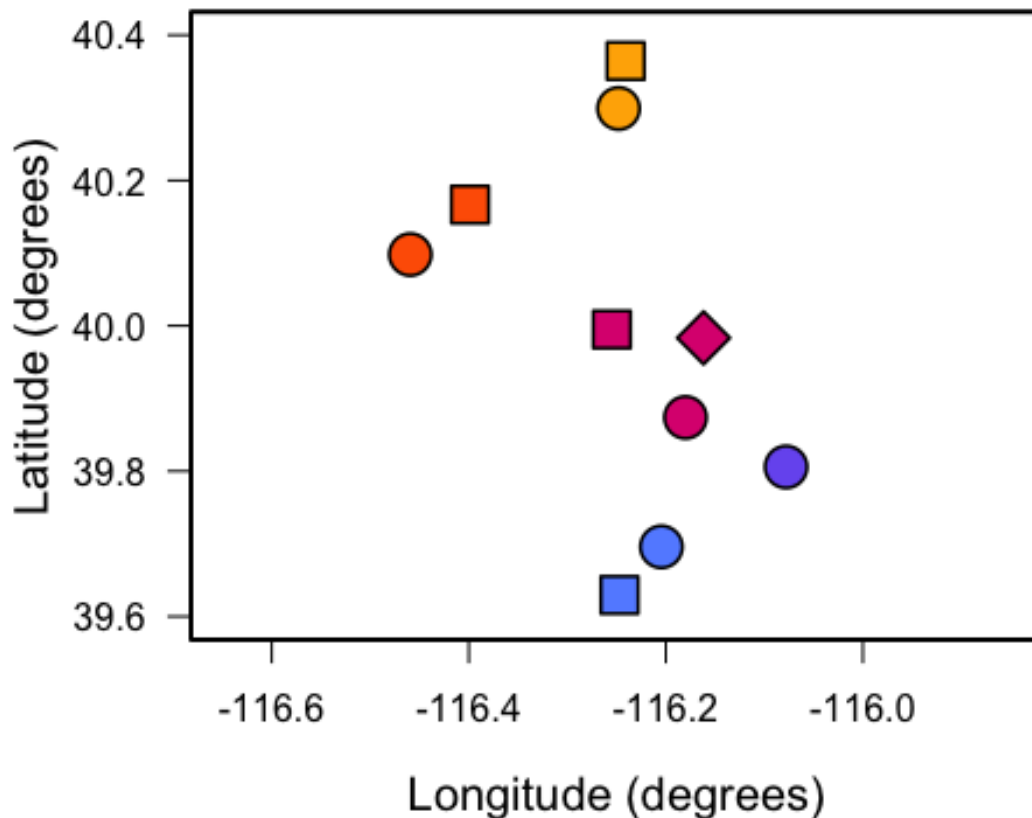
*## v1.3: let's use aesthetically pleasing, color blind friendly colors*

```
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#FE6100", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#FE6100", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#648FFF", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#648FFF", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#FFB000", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#FFB000", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#785EF0", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
```

```

bg="#DC267F", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#DC267F", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#DC267F", cex=2.5, lwd=1.5)

```



```

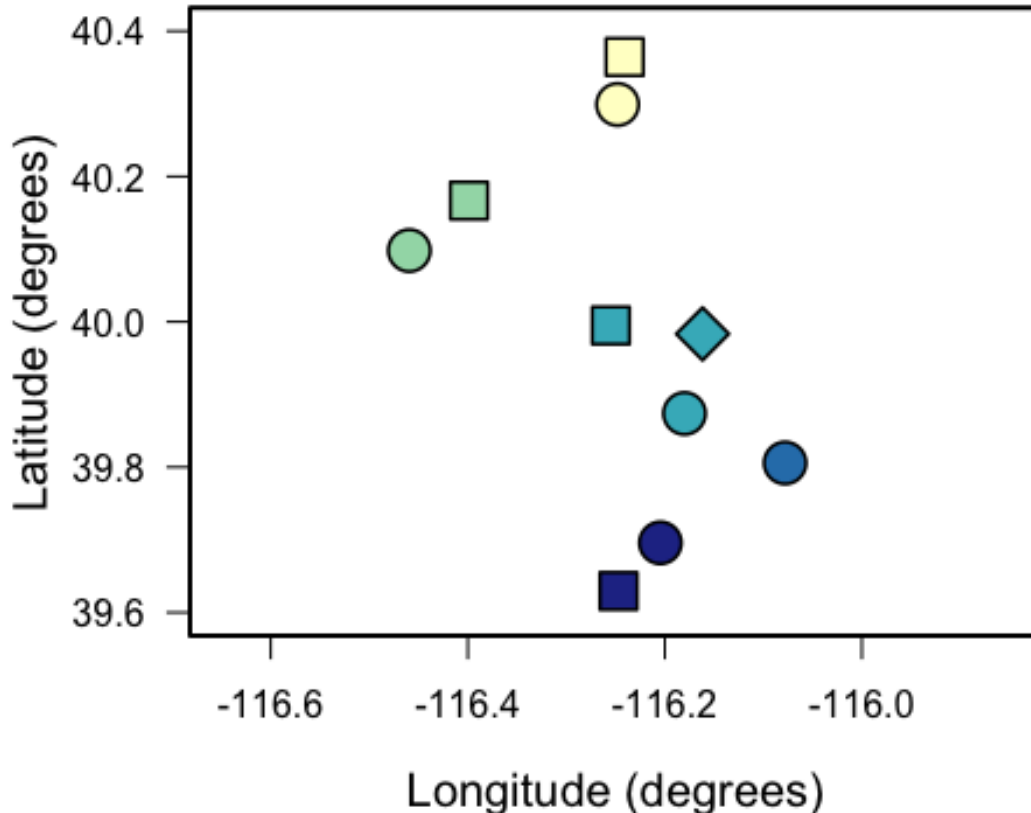
## v1.4: that last palette wasn't that great, try again
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)

```

```

points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)

```



```

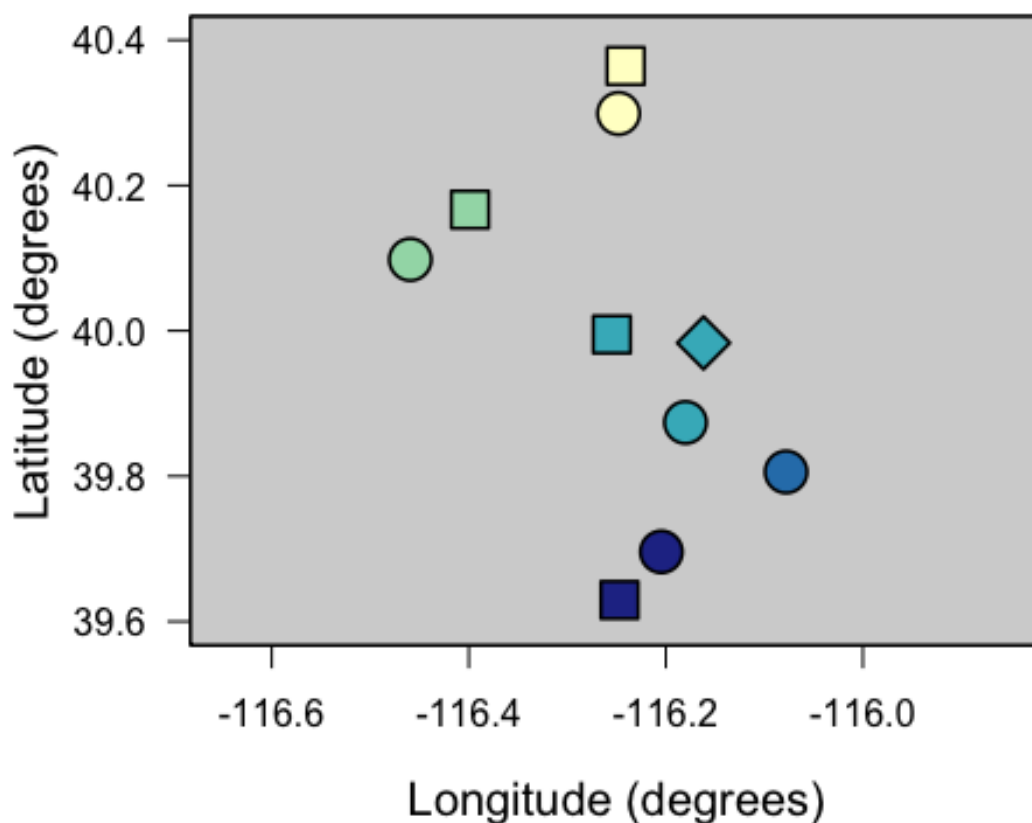
## v1.5: let's add a gray background since we have a really light color
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)

```

```

points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)

```



*## v1.6: let's add a legend*

```

par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)

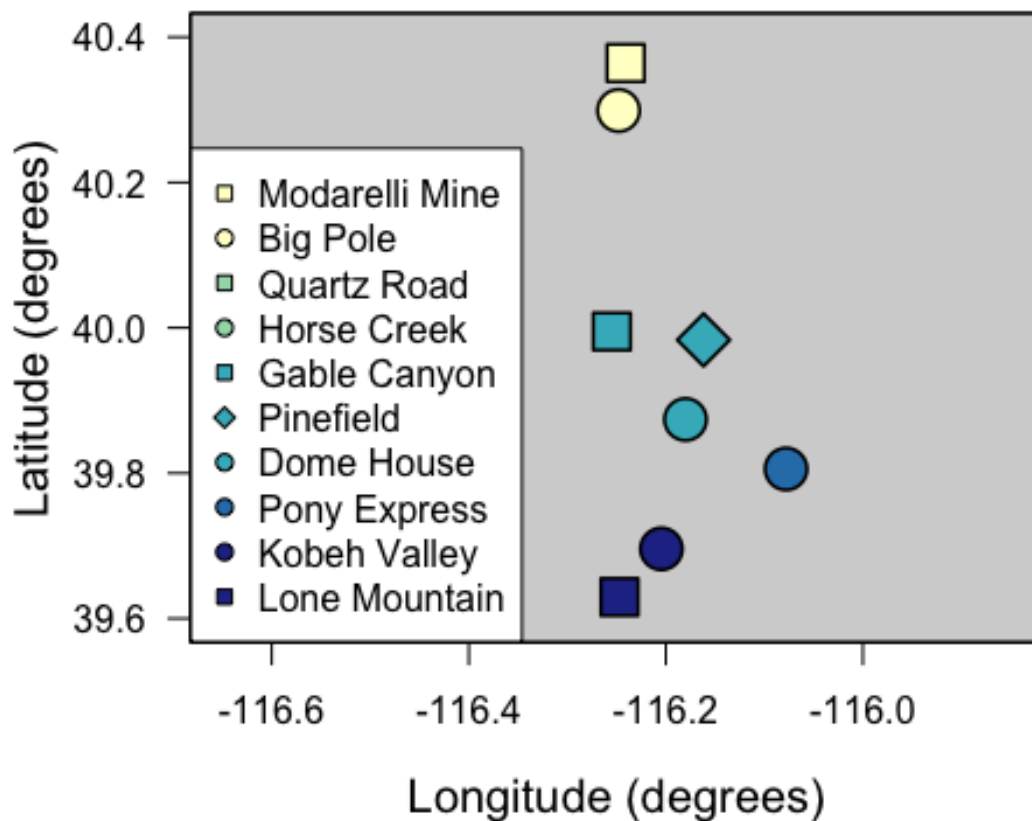
```



```

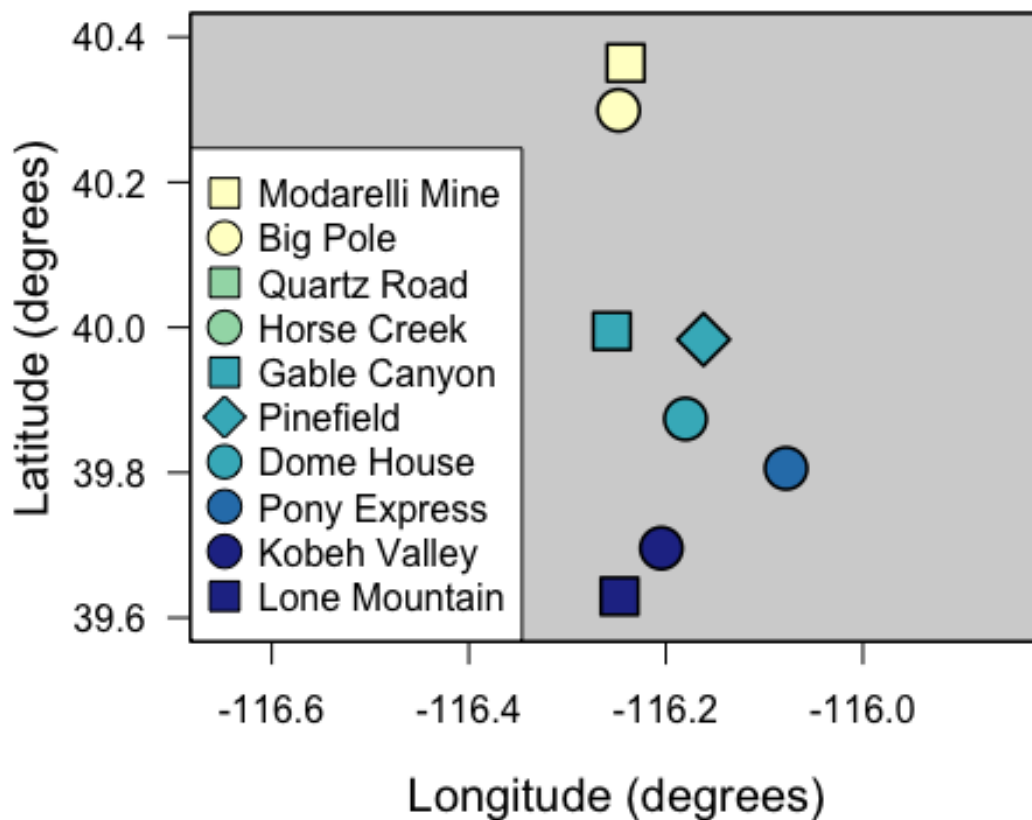
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#ffffcc",
"#ffffcc", "#a1dab4", "#a1dab4", "#41b6c4", "#41b6c4", "#41b6c4", "#2c7fb8",
"#253494", "#253494"))

```



*## v1.7: make legend points larger*

```
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#ffffcc",
"#ffffcc", "#a1dab4", "#a1dab4", "#41b6c4", "#41b6c4", "#41b6c4", "#2c7fb8",
"#253494", "#253494"), pt.cex=2)
```



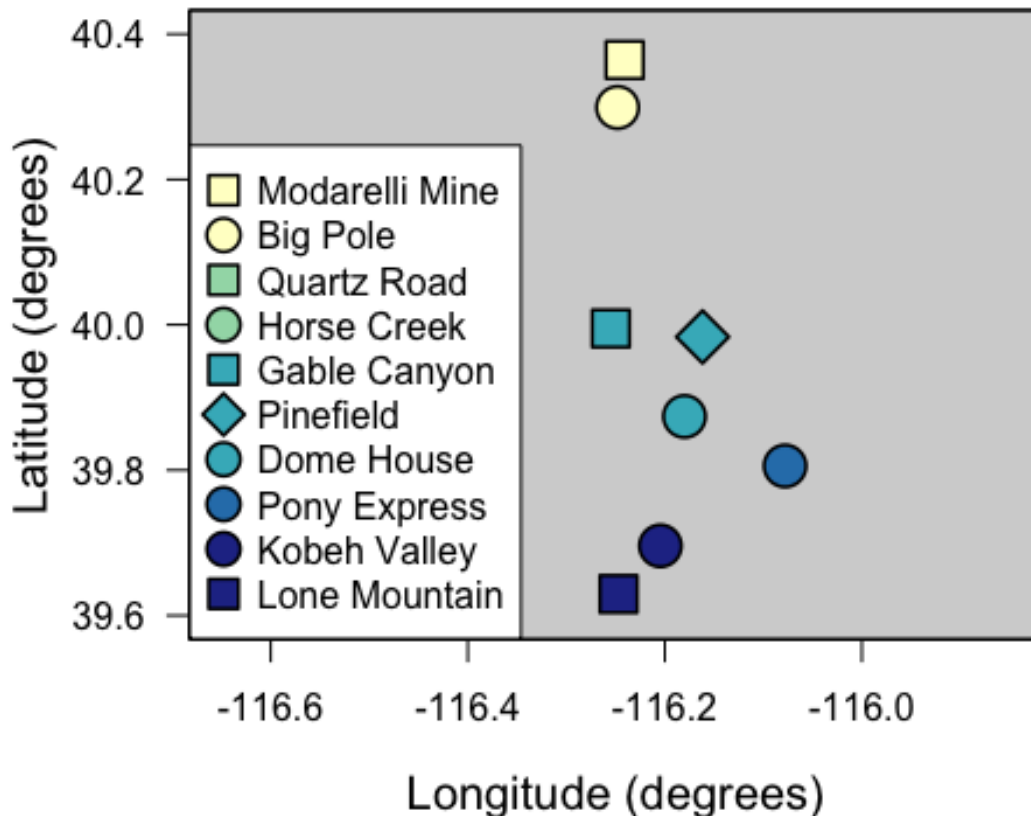
*## v1.8: make legend points lines thicker*

```
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
```

```

points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#ffffcc",
"#ffffcc", "#a1dab4", "#a1dab4", "#41b6c4", "#41b6c4", "#41b6c4", "#2c7fb8",
"#253494", "#253494"), pt.cex=2, pt.lwd=1.5)

```



*## v1.9: make legend box line thicker*

```

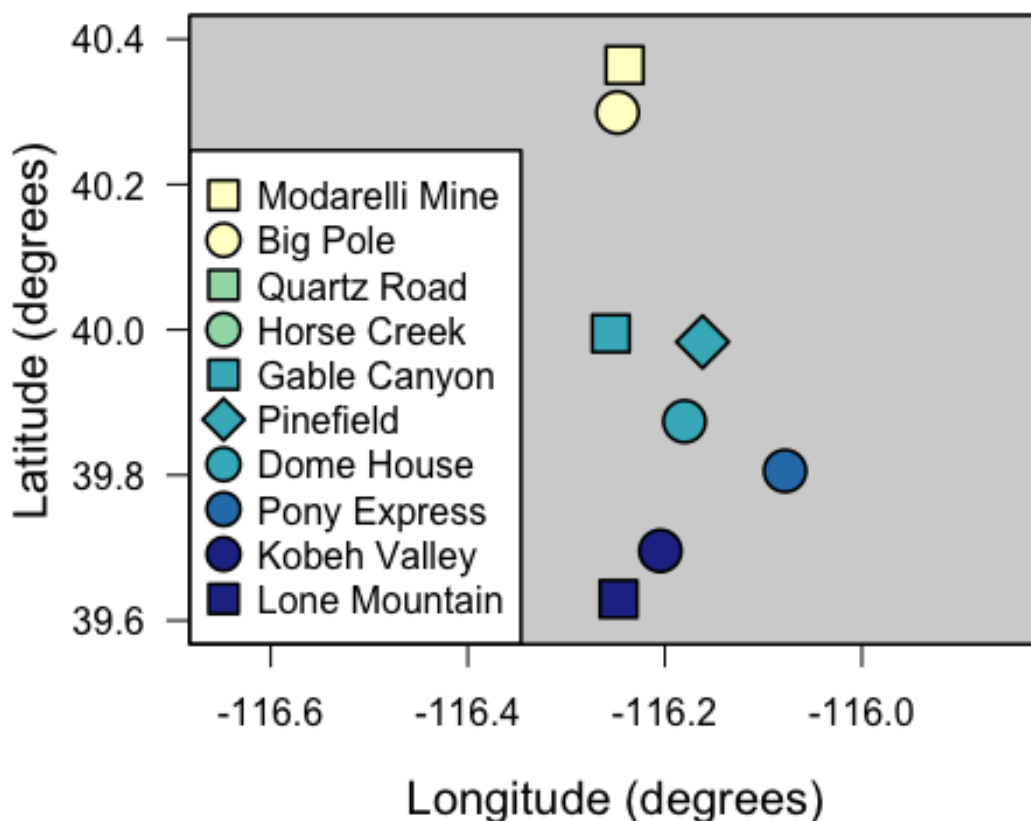
par(mar=c(5,5,1,1))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,

```

```

bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#ffffcc",
"#ffffcc", "#a1dab4", "#a1dab4", "#41b6c4", "#41b6c4", "#41b6c4", "#2c7fb8",
"#253494", "#253494"), pt.cex=2, pt.lwd=1.5, box.lwd=1.5)

```



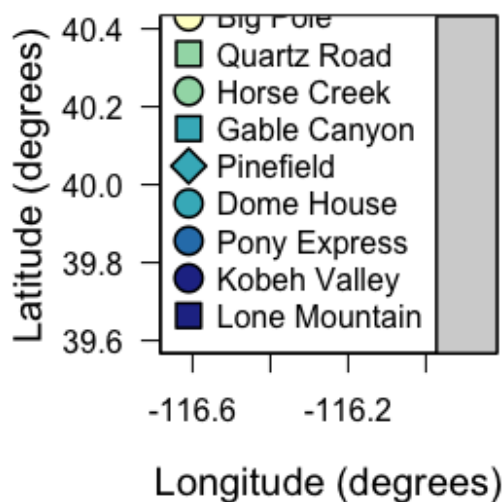
*## add pca next to map*

*## v2.1: use par(mfrow) to add another plot panel*

```

par(mar=c(5,5,1,1), mfrow=c(1,2))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#ffffcc",
"#ffffcc", "#a1dab4", "#a1dab4", "#41b6c4", "#41b6c4", "#41b6c4", "#2c7fb8",
"#253494", "#253494"), pt.cex=2, pt.lwd=1.5, box.lwd=1.5)

```



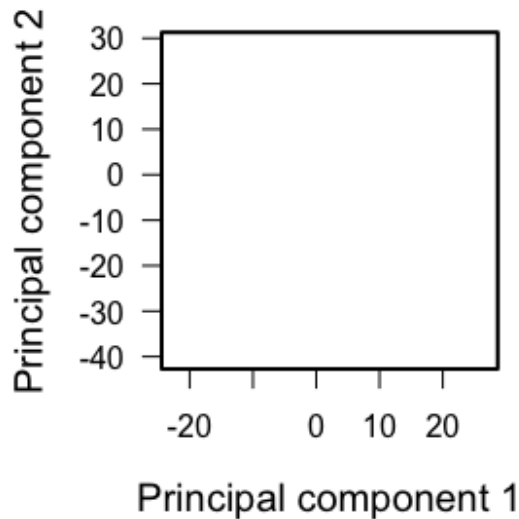
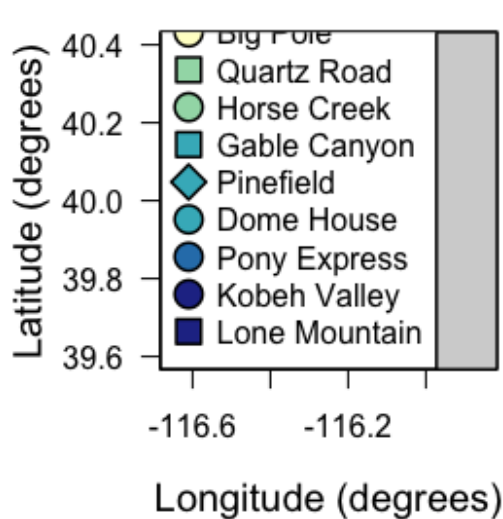
*## v2.2: start with an empty pca plot*  
par(mar=c(5,5,1,1), mfrow=c(1,2))

```

plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#ffffcc",
"#ffffcc", "#a1dab4", "#a1dab4", "#41b6c4", "#41b6c4", "#41b6c4", "#2c7fb8",
"#253494", "#253494"), pt.cex=2, pt.lwd=1.5, box.lwd=1.5)

plot(grouse_data[,6], grouse_data[,7], type="n", xlab="Principal component 1",
ylab="Principal component 2", cex.lab=1.25, las=1); box(lwd=2)

```





*## v2.3: add pca points (shapes and colors match map)*

```
par(mar=c(5,5,1,1), mfrow=c(1,2))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,2,4]), as.numeric(map_mat[,2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,3,4]), as.numeric(map_mat[,3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,4,4]), as.numeric(map_mat[,4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,5,4]), as.numeric(map_mat[,5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,6,4]), as.numeric(map_mat[,6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,7,4]), as.numeric(map_mat[,7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,8,4]), as.numeric(map_mat[,8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,9,4]), as.numeric(map_mat[,9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,10,4]), as.numeric(map_mat[,10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#ffffcc",
"#ffffcc", "#a1dab4", "#a1dab4", "#41b6c4", "#41b6c4", "#41b6c4", "#2c7fb8",
"#253494", "#253494"), pt.cex=2, pt.lwd=1.5, box.lwd=1.5)

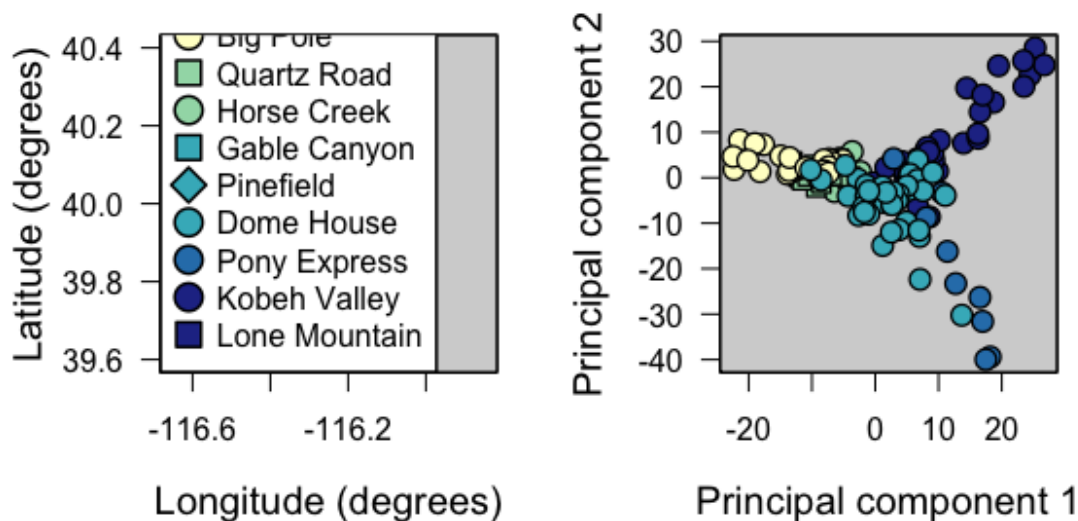
plot(grouse_data[,6], grouse_data[,7], type="n", xlab="Principal component 1",
ylab="Principal component 2", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(grouse_data[grouse_data[,2]=="CO_HC",6],
grouse_data[grouse_data[,2]=="CO_HC",7], pch=21, bg="#a1dab4", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="CO_QR",6],
grouse_data[grouse_data[,2]=="CO_QR",7], pch=22, bg="#a1dab4", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="KV_KB",6],
grouse_data[grouse_data[,2]=="KV_KB",7], pch=21, bg="#253494", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="KV_LM",6],
grouse_data[grouse_data[,2]=="KV_LM",7], pch=21, bg="#253494", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="NC_BP",6],
grouse_data[grouse_data[,2]=="NC_BP",7], pch=21, bg="#ffffcc", cex=1.5,
lwd=1.25)
```



```

points(grouse_data[grouse_data[,2]=="NC_MM",6],
grouse_data[grouse_data[,2]=="NC_MM",7], pch=21, bg="#ffffcc", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="PE_PE",6],
grouse_data[grouse_data[,2]=="PE_PE",7], pch=21, bg="#2c7fb8", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="PV_DH",6],
grouse_data[grouse_data[,2]=="PV_DH",7], pch=21, bg="#41b6c4", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="PV_GC",6],
grouse_data[grouse_data[,2]=="PV_GC",7], pch=21, bg="#41b6c4", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="PV_PF",6],
grouse_data[grouse_data[,2]=="PV_PF",7], pch=21, bg="#41b6c4", cex=1.5,
lwd=1.25)

```



### ## v2.4: swap pcs 1 and 2

```

par(mar=c(5,5,1,1), mfrow=c(1,2))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[1,4]), as.numeric(map_mat[1,3]), pch=21,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[2,4]), as.numeric(map_mat[2,3]), pch=22,
bg="#a1dab4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[3,4]), as.numeric(map_mat[3,3]), pch=21,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[4,4]), as.numeric(map_mat[4,3]), pch=22,
bg="#253494", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[5,4]), as.numeric(map_mat[5,3]), pch=21,
bg="#ffffcc", cex=2.5, lwd=1.5)

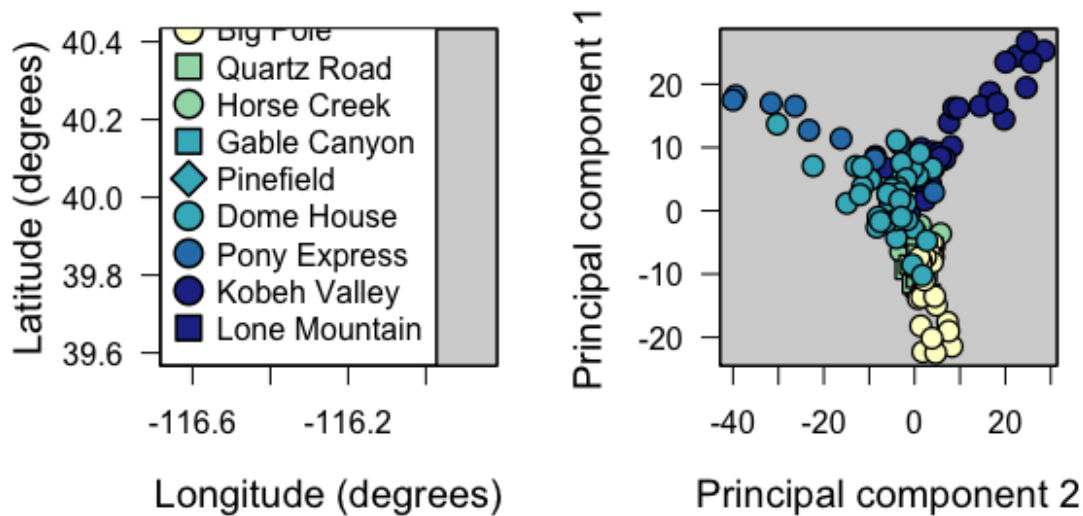
```

```

points(as.numeric(map_mat[6,4]), as.numeric(map_mat[6,3]), pch=22,
bg="#ffffcc", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[7,4]), as.numeric(map_mat[7,3]), pch=21,
bg="#2c7fb8", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[8,4]), as.numeric(map_mat[8,3]), pch=21,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[9,4]), as.numeric(map_mat[9,3]), pch=22,
bg="#41b6c4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[10,4]), as.numeric(map_mat[10,3]), pch=23,
bg="#41b6c4", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#ffffcc",
"#ffffcc", "#a1dab4", "#a1dab4", "#41b6c4", "#41b6c4", "#41b6c4", "#2c7fb8",
"#253494", "#253494"), pt.cex=2, pt.lwd=1.5, box.lwd=1.5)

plot(grouse_data[,7], grouse_data[,6], type="n", xlab="Principal component 2",
ylab="Principal component 1", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(grouse_data[grouse_data[,2]=="CO_HC",7],
grouse_data[grouse_data[,2]=="CO_HC",6], pch=21, bg="#a1dab4", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="CO_QR",7],
grouse_data[grouse_data[,2]=="CO_QR",6], pch=22, bg="#a1dab4", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="KV_KB",7],
grouse_data[grouse_data[,2]=="KV_KB",6], pch=21, bg="#253494", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="KV_LM",7],
grouse_data[grouse_data[,2]=="KV_LM",6], pch=21, bg="#253494", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="NC_BP",7],
grouse_data[grouse_data[,2]=="NC_BP",6], pch=21, bg="#ffffcc", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="NC_MM",7],
grouse_data[grouse_data[,2]=="NC_MM",6], pch=21, bg="#ffffcc", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="PE_PE",7],
grouse_data[grouse_data[,2]=="PE_PE",6], pch=21, bg="#2c7fb8", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="PV_DH",7],
grouse_data[grouse_data[,2]=="PV_DH",6], pch=21, bg="#41b6c4", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="PV_GC",7],
grouse_data[grouse_data[,2]=="PV_GC",6], pch=21, bg="#41b6c4", cex=1.5,
lwd=1.25)
points(grouse_data[grouse_data[,2]=="PV_PF",7],
grouse_data[grouse_data[,2]=="PV_PF",6], pch=21, bg="#41b6c4", cex=1.5,
lwd=1.25)

```



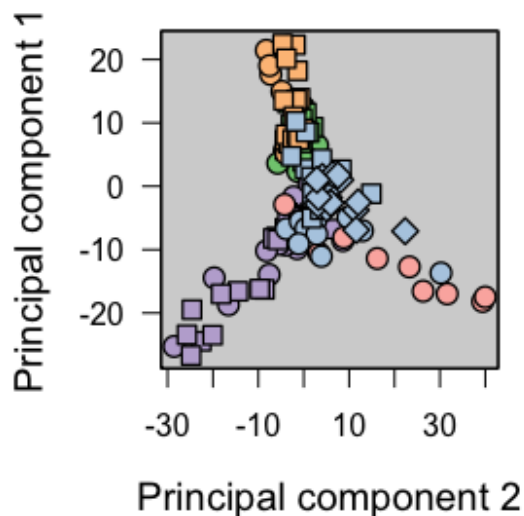
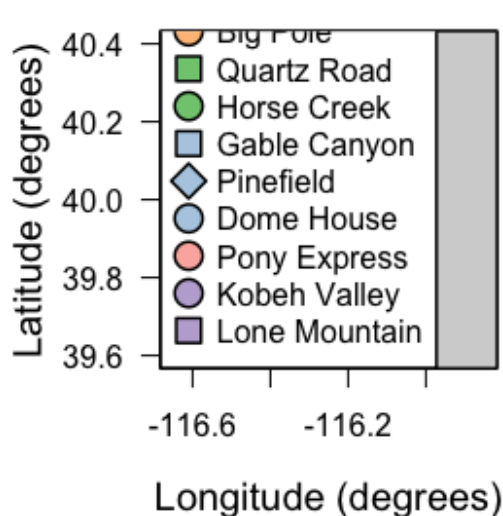
*## v2.5: flip the x and y axes on the pca*

```
par(mar=c(5,5,1,1), mfrow=c(1,2))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[,1,4]), as.numeric(map_mat[,1,3]), pch=21,
bg="#7fc97f", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,2,4]), as.numeric(map_mat[,2,3]), pch=22,
bg="#7fc97f", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,3,4]), as.numeric(map_mat[,3,3]), pch=21,
bg="#beaed4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,4,4]), as.numeric(map_mat[,4,3]), pch=22,
bg="#beaed4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,5,4]), as.numeric(map_mat[,5,3]), pch=21,
bg="#fdc086", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,6,4]), as.numeric(map_mat[,6,3]), pch=22,
bg="#fdc086", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,7,4]), as.numeric(map_mat[,7,3]), pch=21,
bg="#fbb4ae", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,8,4]), as.numeric(map_mat[,8,3]), pch=21,
bg="#b3cde3", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,9,4]), as.numeric(map_mat[,9,3]), pch=22,
bg="#b3cde3", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,10,4]), as.numeric(map_mat[,10,3]), pch=23,
bg="#b3cde3", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#fdc086",
"#fdc086", "#7fc97f", "#7fc97f", "#b3cde3", "#b3cde3", "#b3cde3", "#fbb4ae",
"#beaed4", "#beaed4"), pt.cex=2, pt.lwd=1.5, box.lwd=1.5)
```

```

plot(-1*grouse_data[,7], -1*grouse_data[,6], type="n", xlab="Principal component
2", ylab="Principal component 1", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(-1*grouse_data[grouse_data[,2]=="CO_HC",7], -
1*grouse_data[grouse_data[,2]=="CO_HC",6], pch=21, bg="#7fc97f", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="CO_QR",7], -
1*grouse_data[grouse_data[,2]=="CO_QR",6], pch=22, bg="#7fc97f", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="KV_KB",7], -
1*grouse_data[grouse_data[,2]=="KV_KB",6], pch=21, bg="#beaed4", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="KV_LM",7], -
1*grouse_data[grouse_data[,2]=="KV_LM",6], pch=22, bg="#beaed4", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="NC_BP",7], -
1*grouse_data[grouse_data[,2]=="NC_BP",6], pch=21, bg="#fdc086", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="NC_MM",7], -
1*grouse_data[grouse_data[,2]=="NC_MM",6], pch=22, bg="#fdc086", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="PE_PE",7], -
1*grouse_data[grouse_data[,2]=="PE_PE",6], pch=21, bg="#fbb4ae", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="PV_DH",7], -
1*grouse_data[grouse_data[,2]=="PV_DH",6], pch=21, bg="#b3cde3", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="PV_GC",7], -
1*grouse_data[grouse_data[,2]=="PV_GC",6], pch=22, bg="#b3cde3", cex=1.5,
lwd=1.25)
points(-1*grouse_data[grouse_data[,2]=="PV_PF",7], -
1*grouse_data[grouse_data[,2]=="PV_PF",6], pch=23, bg="#b3cde3", cex=1.5,
lwd=1.25)

```



*## fireworks plot awesomeness*

*## v3.1: flip the x and y axes on the pca*

```
par(mar=c(5,5,1,1), mfrow=c(1,2))
plot(as.numeric(map_mat[,4]), as.numeric(map_mat[,3]), type="n", ylim=c(39.6,
40.4), xlim=c(-116.65, -115.85), xlab="Longitude (degrees)", ylab="Latitude
(degrees)", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
points(as.numeric(map_mat[,1,4]), as.numeric(map_mat[,1,3]), pch=21,
bg="#7fc97f", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,2,4]), as.numeric(map_mat[,2,3]), pch=22,
bg="#7fc97f", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,3,4]), as.numeric(map_mat[,3,3]), pch=21,
bg="#beaed4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,4,4]), as.numeric(map_mat[,4,3]), pch=22,
bg="#beaed4", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,5,4]), as.numeric(map_mat[,5,3]), pch=21,
bg="#fdc086", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,6,4]), as.numeric(map_mat[,6,3]), pch=22,
bg="#fdc086", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,7,4]), as.numeric(map_mat[,7,3]), pch=21,
bg="#fbb4ae", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,8,4]), as.numeric(map_mat[,8,3]), pch=21,
bg="#b3cde3", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,9,4]), as.numeric(map_mat[,9,3]), pch=22,
bg="#b3cde3", cex=2.5, lwd=1.5)
points(as.numeric(map_mat[,10,4]), as.numeric(map_mat[,10,3]), pch=23,
bg="#b3cde3", cex=2.5, lwd=1.5)
legend("bottomleft", legend=c("Modarelli Mine", "Big Pole", "Quartz Road", "Horse
Creek", "Gable Canyon", "Pinefield", "Dome House", "Pony Express", "Kobeh Valley",
"Lone Mountain"), pch=c(22,21,22,21,22,23,21,21,21,22), pt.bg=c("#fdc086",
"#fdc086", "#7fc97f", "#7fc97f", "#b3cde3", "#b3cde3", "#b3cde3", "#fbb4ae",
"#beaed4", "#beaed4"), pt.cex=2, pt.lwd=1.5, box.lwd=1.5)

firework_colors <- c("#7fc97f", "#7fc97f", "#beaed4", "#beaed4", "#fdc086",
"#fdc086", "#fbb4ae", "#b3cde3", "#b3cde3", "#b3cde3")
firework_pchs <- c(21,22,21,22,21,22,21,21,21,22)
plot(-1*grouse_data[,7], -1*grouse_data[,6], type="n", xlab="Principal component
2", ylab="Principal component 1", cex.lab=1.25, las=1); box(lwd=2)
rect(par("usr")[1], par("usr")[3], par("usr")[2], par("usr")[4], col="light gray")
mean_long_vect <- vector()
mean_lat_vect <- vector()
for (i in 1:length(unique_leks))
{
  sub_pca <- subset(grouse_data, grouse_data[,2]==unique_leks[i])
  mean_long_vect[i] <- -1 * mean(as.numeric(sub_pca[,7]))
  mean_lat_vect[i] <- -1 * mean(as.numeric(sub_pca[,6]))
  for (j in 1:dim(sub_pca)[1])
  {
```

```

        segments(mean_long_vect[i], mean_lat_vect[i], -1*sub_pca[,7], -1*sub_pca[,6],
lwd=2, col=firework_colors[i])
    }
}
for (i in 1: length(unique_leks))
{
    points(mean_long_vect[i], mean_lat_vect[i], pch=firework_pchs[i],
bg=firework_colors[i], cex=2.5, lwd=1.5)
}

```

