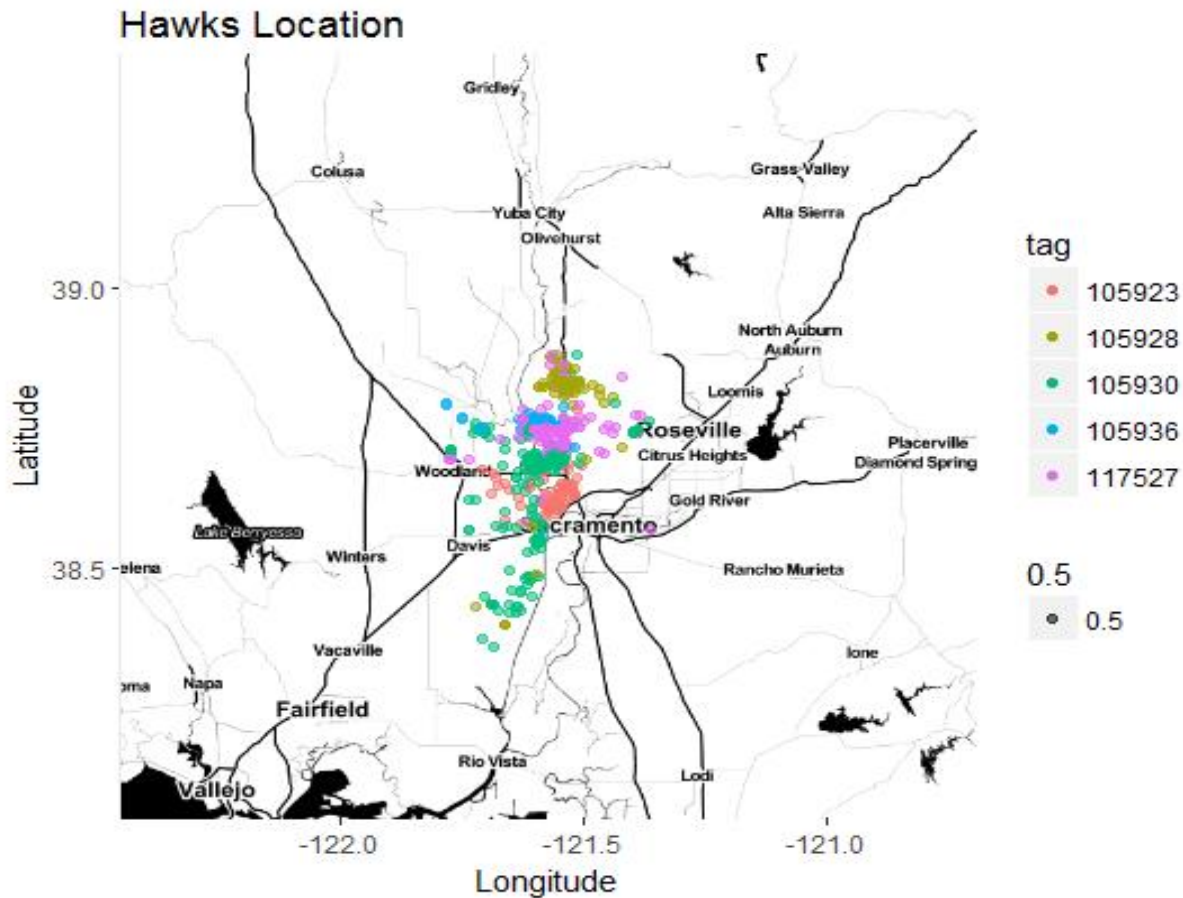STA 141A HW4

Zihan Mo 914998952

May 31, 2018

Q1.

Hawks Location

5 different hawks' movement sequences are recorded within longitude (-121.7843 -121.3615) and latitude (38.3565 38.8835). The denser color for each hawk means they have more activities around these areas.

Q2.

There are only 2 hawks, 105936 and 105928, have arrival stage. In the plots, the bigger the point is, the higher the hawk is at a specific time. Then lighter the color is, the higher the speed is. Also, the arrow means the direction the hawk is flying to. The cluster points imply where the hawks' nest is.

hawk105936

hawk105928
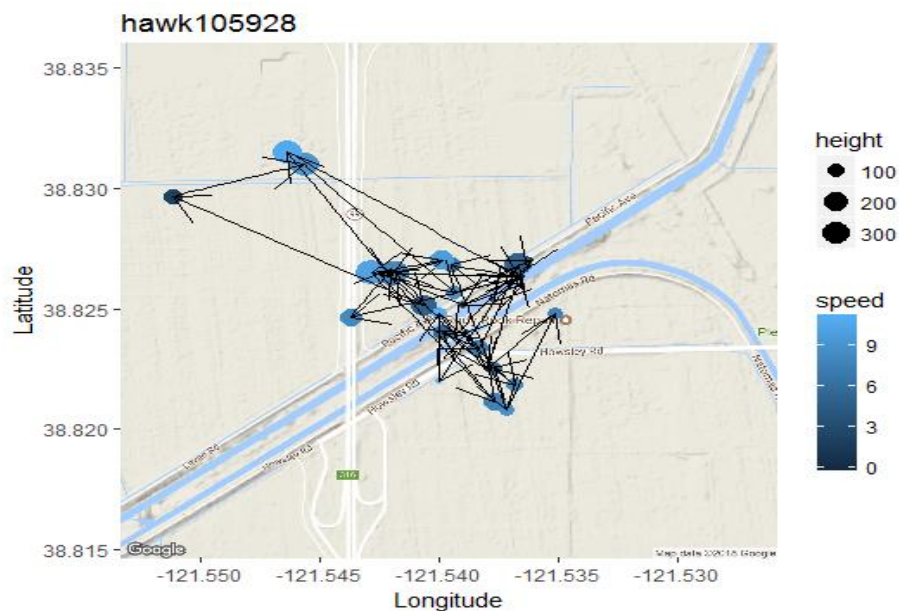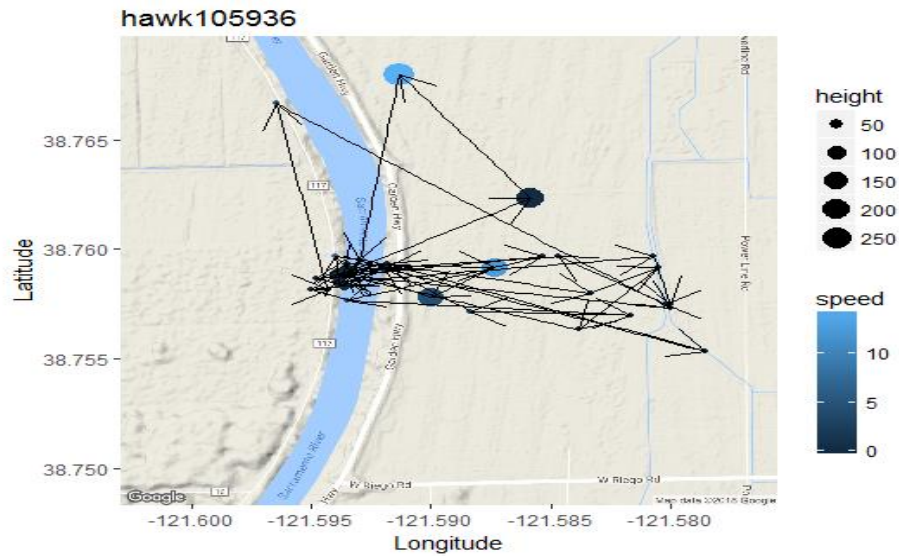
Q3.

Decision rules if the hawk leaves:

1. If the distance from the nest is above 7.5 miles, the hawk is leaving during the time period;

2. If the distance keeps increasing or stays relatively large, the hawk is leaving during the time period

Based on these 2 rules and the plots below, only hawk 105928 and hawk 10596 meet the criterions. Therefore, I believe hawk 105928 is leaving between 9/13/2012 20:00 and 9/14/2012 3:00. Hawk 105936 is leaving between 8/5/2012 18:00 and 8/6/2012 2:00.

hawk105936

hawk117527

Q4
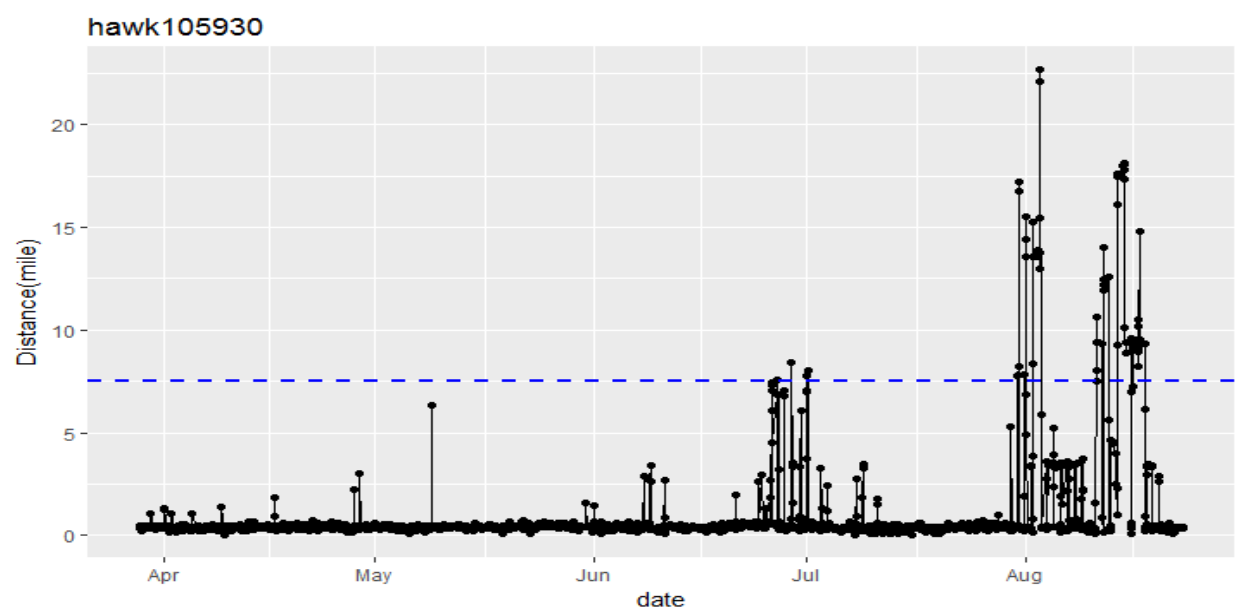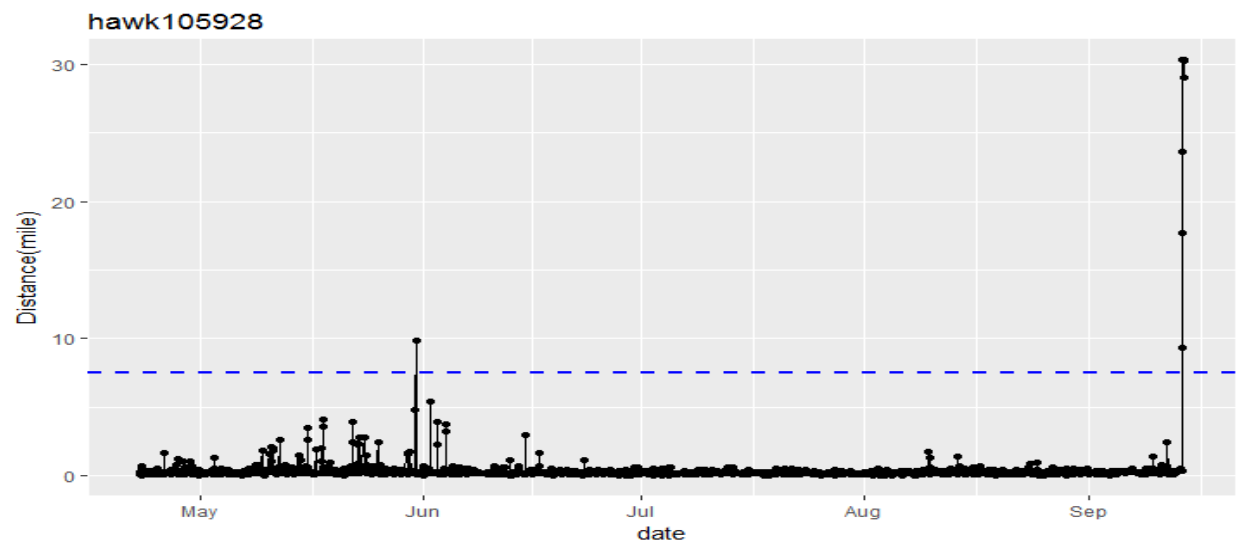
Based on the conslusion from Q3, there are only 2 hawks, 105936 and 105928, actually leaving. In the plots, the bigger the point is, the higher the hawk is at a specific time. Then lighter the color is, the higher the speed is. Also, the arrow means the direction the hawk is flying to. The cluster points imply where the hawks' nest is. Different colors represent different date time.
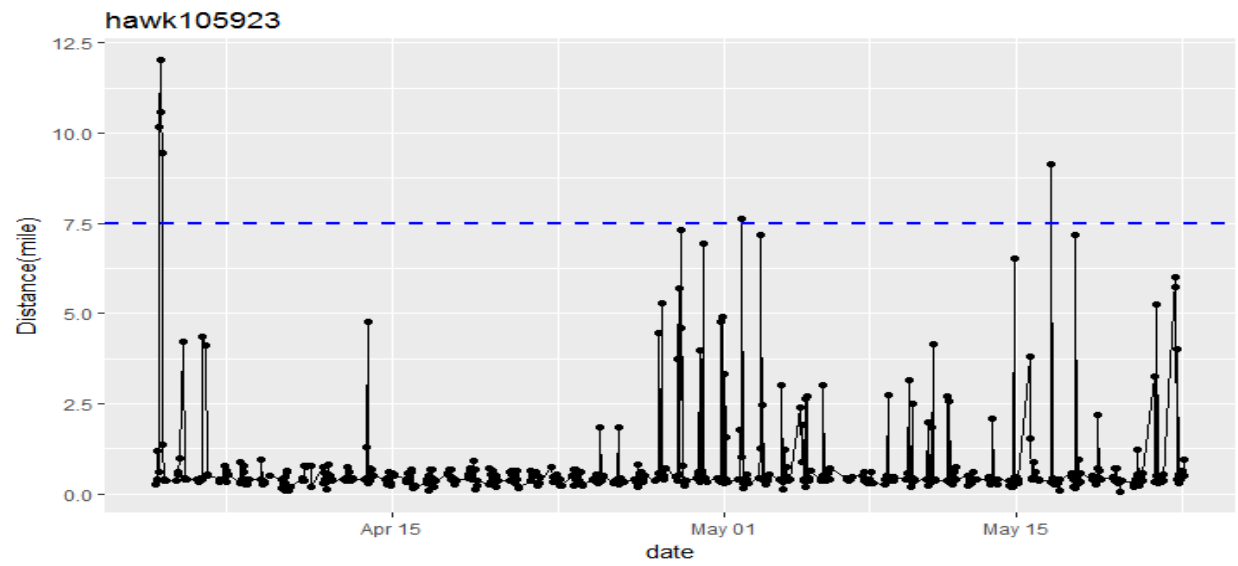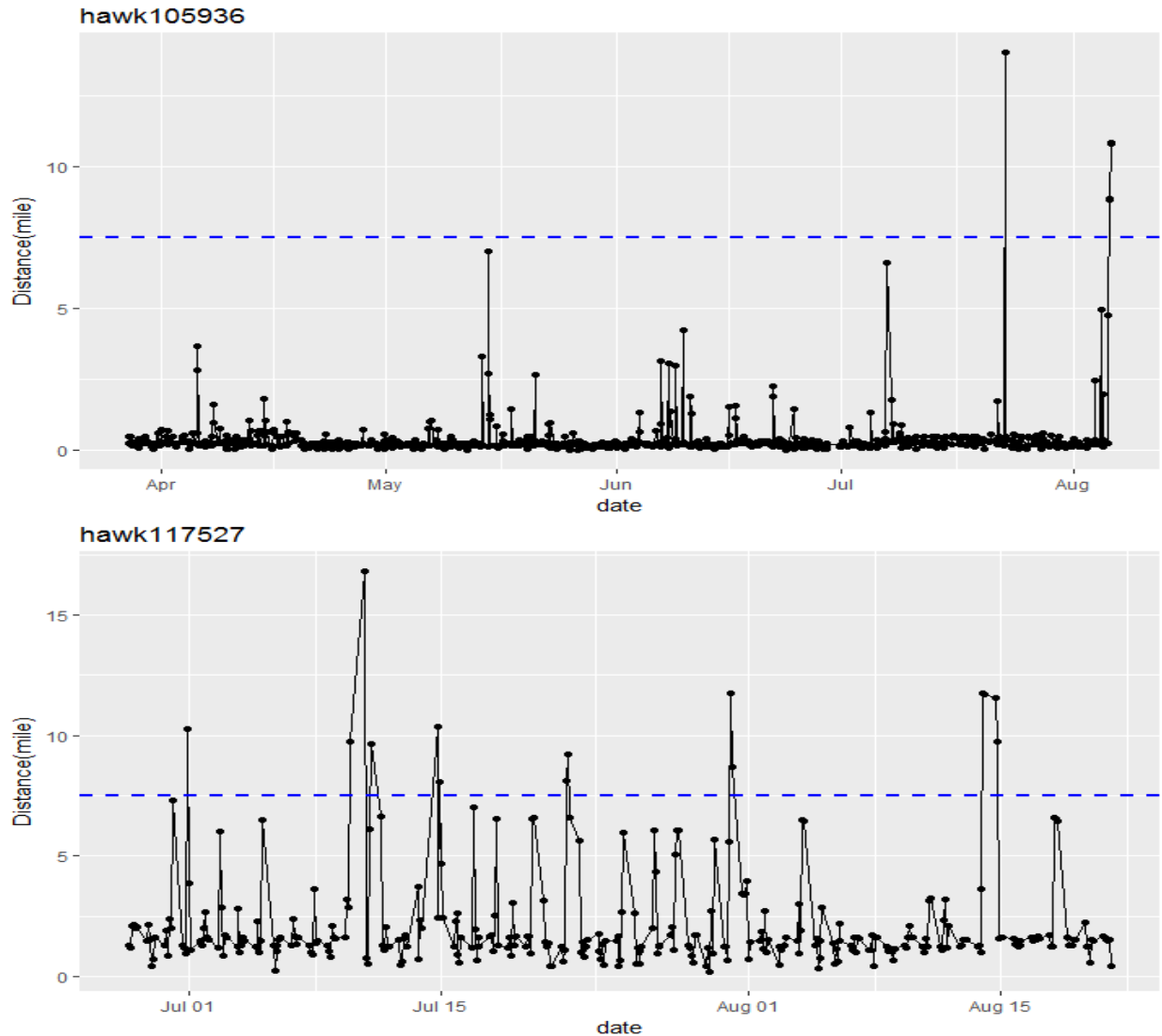
Hawks magration patterns:

Hawks 105928 and 105936 have 4 stages: arrival, nestling, preHatching, and preMigration, while hawk 105923 has two stages: nestling and preHatching, hawk 117527 has two stages: nestling and preMigration. Hawk 15930 has 3 stages: nestling, preHatching, and preMigration. Only Hawk 105928 and 105936 are actually leaving at the end of the time period. Other three hawks should've inhabited in the area before the records.
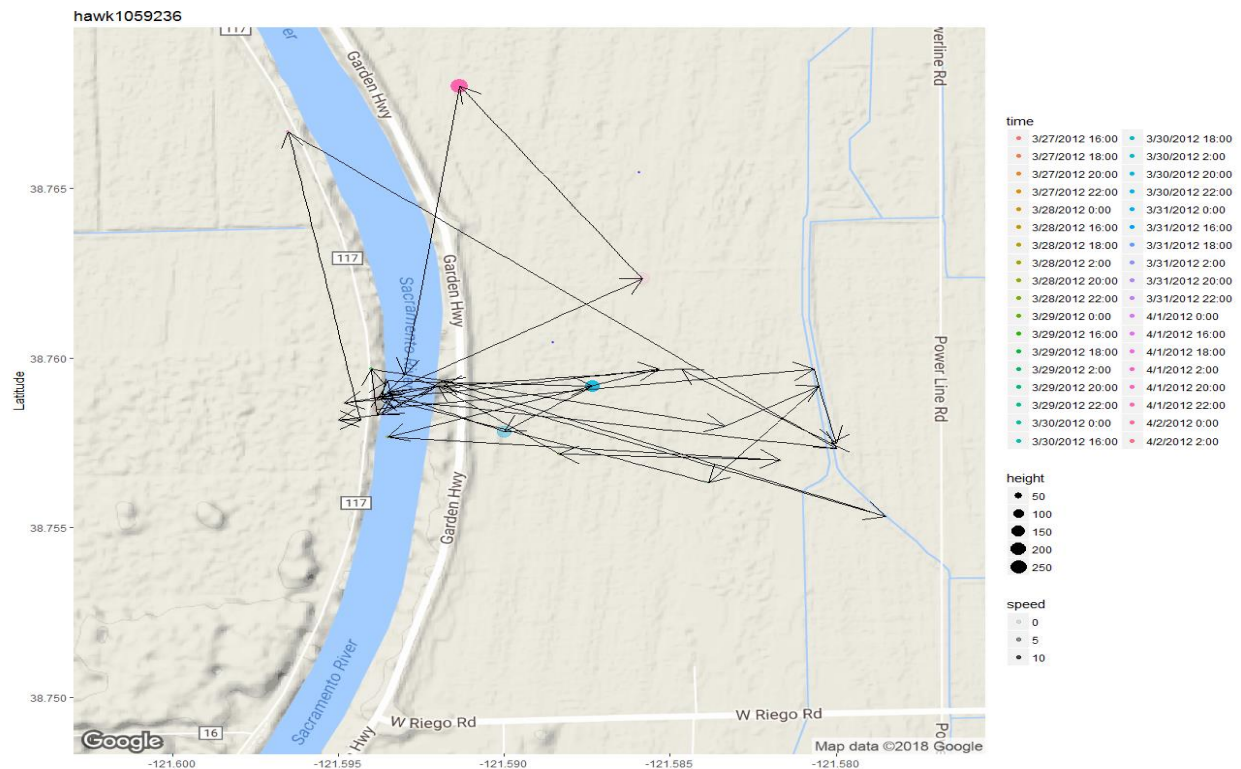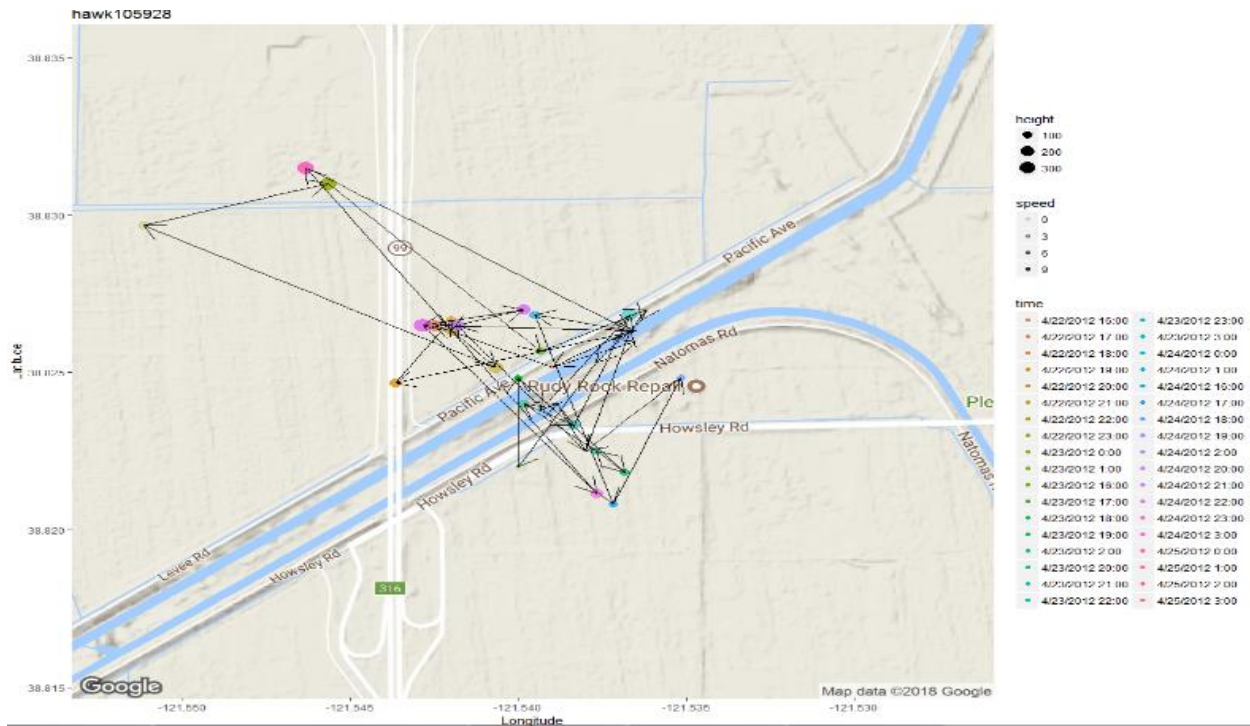
Reference: Patrick and Piazza

```r
data<-read.csv('the_hawks.csv')

library(ggplot2)

library(ggmap)

library(geosphere)

library(lubridate)

#Q1

data$tag<-as.factor(data$tag)

levels(data$tag) #check for different tag

loc<-subset(data[,c(3,4)])

map<-get_map(loc,maptype = 'toner',zoom=9,source="stamen",scale=1)

ggmap(map)+geom_jitter(data = data,
  aes(x=long,y=lat,color=tag,size=0.5,alpha=.5))+
  ggtitle("Hawks Location")+xlab('Longitude')+ylab('Latitude')

range(data$long)


#Q2

arrival <- subset(data, stage=="arrival")

arrival1 <- subset(arrival, tag == '105936')

arrival2 <- subset(arrival, tag == '105928')

loch1<-arrival1[,c(3,4)]

loch2<-arrival2[,c(3,4)]

L<-cbind(loch1$long,loch1$lat)

L2<-cbind(L[-nrow(L),],L[-1,])

colnames(L2)<-c("long1","lat1","long2","lat2")

L2<-data.frame(L2)

map2<-get_map(loch1,zoom=15,scale = 2)

ggmap(map2)+geom_point(data=arrival1, aes(x=long,y=lat,size=height,color=speed))+
  geom_segment(data=L2,aes(x=long1,y=lat1,xend=long2,yend=lat2),
               arrow = arrow())+
  ggtitle("hawk105936")+xlab('Longitude')+ylab('Latitude')

L3<-cbind(loch2$long,loch2$lat)

L4<-cbind(L3[-nrow(L3),],L3[-1,])

colnames(L4)<-c("long1","lat1","long2","lat2")
```

```
L4<-data.frame(L4)

map3<-get_map(loch2,zoom=15)

ggmap(map3)+geom_point(data=arrival2, aes(x=long,y=lat,size=height,color=speed))+

  geom_segment(data=L4,aes(x=long1,y=lat1,xend=long2,yend=lat2),

          arrow = arrow())+

  ggtitle("hawk105928")+xlab('Longitude')+ylab('Latitude')

#Q3

data$time<-mdy_hm(data$time)

hawks<-split(data,tag)

nestlong<-aggregate(long~tag,data,mean)

nestlat<-aggregate(lat~tag,data,mean)

nests<-merge(nestlong,nestlat,by="tag")

levels(data$tag)

hawk1loc<-cbind(hawks[[1]]$long,hawks[[1]]$lat)

hawk1nest<-nests[1,c(2,3)]

dist1<-distGeo(hawk1loc,hawk1nest)

dist1<-data.frame(dist1)

dist1<-cbind(dist1,hawks[[1]])

ggplot(aes(x = mdy_hm(time), y = dist1/1609), data = dist1) +

  geom_point()+geom_line()+

  geom_hline(yintercept = 7.5,color = "blue", size=1,lty="dashed")+

  ggtitle("hawk105923")+xlab('date')+ylab('Distance(mile)')+

  theme_bw()


hawk2loc<-cbind(hawks[[2]]$long,hawks[[2]]$lat)

hawk2nest<-nests[2,c(2,3)]

dist2<-distGeo(hawk2loc,hawk2nest)

dist2<-data.frame(dist2)

dist2<-cbind(dist2,hawks[[2]])

ggplot(aes(x = mdy_hm(time), y = dist2/1609), data = dist2) +

  geom_point()+geom_line()+

  geom_hline(yintercept = 7.5,color = "blue", size=1,lty="dashed")+

  ggtitle("hawk105928")+xlab('date')+ylab('Distance(mile)')
```

```r
hawk3loc<-cbind(hawks[[3]]$long,hawks[[3]]$lat)
hawk3nest<-nests[3,c(2,3)]
dist3<-distGeo(hawk3loc,hawk3nest)
dist3<-data.frame(dist3)
dist3<-cbind(dist3,hawks[[3]])
ggplot(aes(x = mdy_hm(time), y = dist3/1609), data = dist3) +
  geom_point()+geom_line()+
  geom_hline(yintercept = 7.5,color = "blue", size=1,lty="dashed")+
  ggtitle("hawk105930")+xlab('date')+ylab('Distance(mile)')


hawk4loc<-cbind(hawks[[4]]$long,hawks[[4]]$lat)
hawk4nest<-nests[4,c(2,3)]
dist4<-distGeo(hawk4loc,hawk4nest)
dist4<-data.frame(dist4)
dist4<-cbind(dist4,hawks[[4]])
ggplot(aes(x = mdy_hm(time), y = dist4/1609), data = dist4) +
  geom_point()+geom_line()+
  geom_hline(yintercept = 7.5,color = "blue", size=1,lty="dashed")+
  ggtitle("hawk105936")+xlab('date')+ylab('Distance(mile)')


hawk5loc<-cbind(hawks[[5]]$long,hawks[[5]]$lat)
hawk5nest<-nests[5,c(2,3)]
dist5<-distGeo(hawk5loc,hawk5nest)
dist5<-data.frame(dist5)
dist5<-cbind(dist5,hawks[[5]])
ggplot(aes(x = mdy_hm(time), y = dist5/1609), data = dist5) +
  geom_point()+geom_line()+
  geom_hline(yintercept = 7.5,color = "blue", size=1,lty="dashed")+
  ggtitle("hawk117527")+xlab('date')+ylab('Distance(mile)')
#actually leave:4 2


#Q4
```

```r
departure <- subset(data, stage=="preMigration")


#departure sequence location of hawk 105928

departure1 <- subset(arrival, tag == '105928')

dloc1<-departure1[,c(3,4)]

L41<-cbind(dloc1$long,dloc1$lat)

L42<-cbind(L41[-nrow(L41),],L41[-1,])

colnames(L42)<-c("long1","lat1","long2","lat2")

L42<-data.frame(L42)

#departure sequence of hawk 105928

map4<-get_map(dloc1,zoom=15,scale = 2)

ggmap(map4)+geom_point(data=departure1, aes(x=long,y=lat,
                          size=height,color=time,alpha=speed))+
  geom_segment(data=L42,aes(x=long1,y=lat1,xend=long2,yend=lat2),
        arrow = arrow())+
  ggtitle("hawk105928")+xlab('Longitude')+ylab('Latitude')


#departure sequence location of hawk 105936

departure2 <- subset(arrival, tag == '105936')

dloc2<-departure2[,c(3,4)]

L43<-cbind(dloc2$long,dloc2$lat)

L44<-cbind(L43[-nrow(L43),],L43[-1,])

colnames(L44)<-c("long1","lat1","long2","lat2")

L44<-data.frame(L44)

#departure sequence of hawk 105936

map5<-get_map(dloc2,zoom=15,scale=2)

ggmap(map5)+geom_point(data=departure2, aes(x=long,y=lat,
                          size=height,color=time,alpha=speed))+
  geom_segment(data=L44,aes(x=long1,y=lat1,xend=long2,yend=lat2),
        arrow = arrow())+
  ggtitle("hawk1059236")+xlab('Longitude')+ylab('Latitude')
```