STA 141A Data Analysis Report
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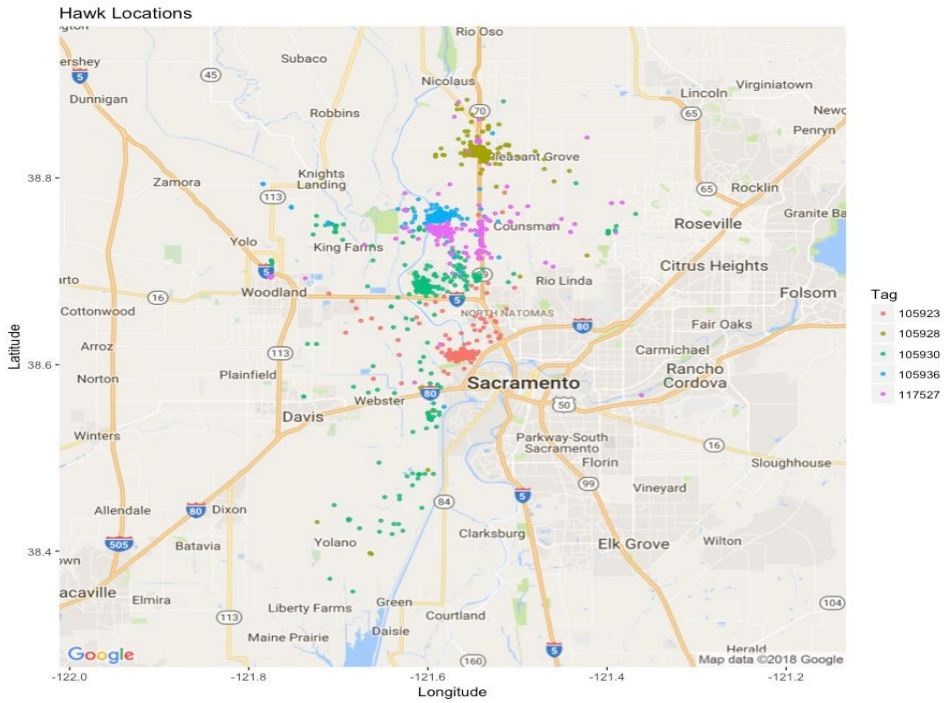
Q1:



The spatial map above shows the location of all five of the hawks. As we can see from the map, the 5 hawks tends to stay mostly to the north of Sacramento. In R, we plot this map and distinguish 5 hawks with different colors. Points in red stands for hawk #105923 and it stays mostly near the western north to Sacramento and sometimes as far as to Woodland and Webster. Points in acid green stands for hawk #105928 and it stays mostly near Pleasant Grove around highway 70. Points in green stands for hawk #105930 and it stays mostly on the cross of highway 99 and highway 5 near North Natomas, plus sometimes in King Farms and along the way down to Yolano. Points in blue stands for hawk #105936 and it stays mostly with points in purple which are hawk #117527 in the western Counsman area.

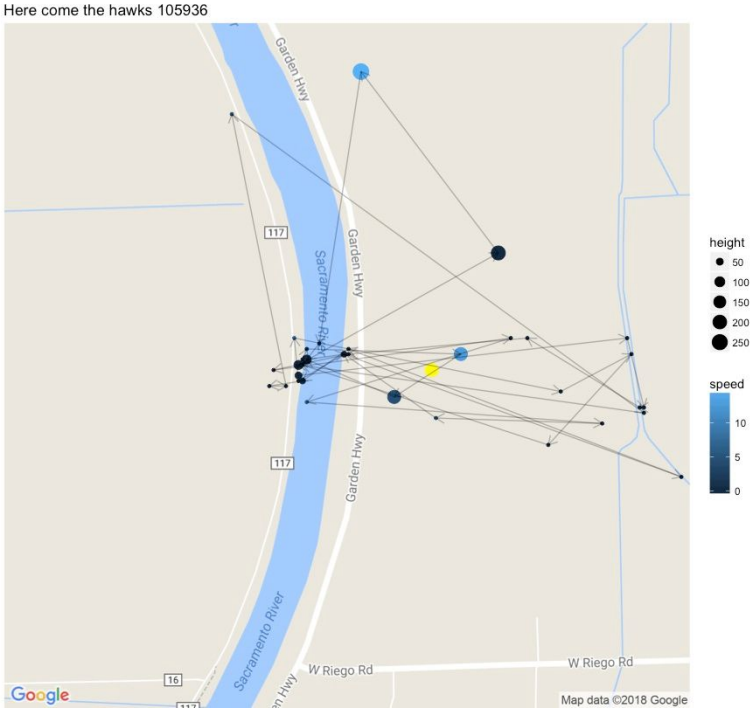
Q2:

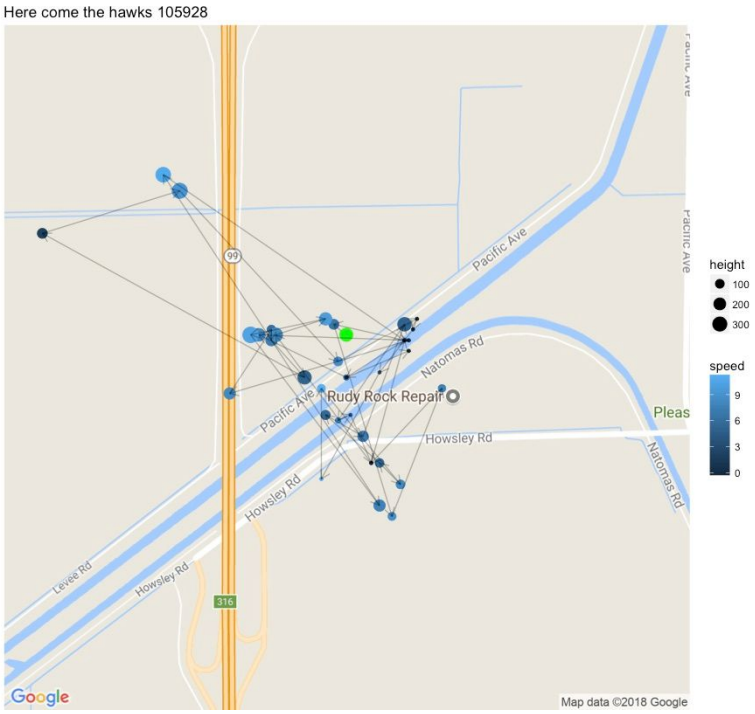
By using R, we found that the two hawks who have documented arrival sequences are hawk #105936 and #105928. In order to plot the spatial map, we then plot the arrival points for each hawk and add lines and arrows between to show how each hawk move in arrival stage. And we also find the estimate nest for each hawk. Since median of each nest by tag is approximately where their nest is, we obtain the median long and lat for it.

In the below maps, for “Here come the hawks 105936” shows the movement for hawk #105936 in arrival stage. We can see that it mainly stays around the Sacramento River to the north of Garden Hwy cross W Riego Rd. The yellow point shows the estimate nest location for this hawk. We notice that this hawk stays to the east of the estimate nest more when it flies low with low speed, and stays to other directions more when it flies high with low speed. There is one large light blue point to the north of the estimated nest, meaning that it flies high with high speed there. One medium large light blue point next to the nest means that it flies medium high with medium speed there.

For “Here come the hawks 105928”, we can see that this hawk mostly nests to the west of Rudy Rock Repair and sometimes cross Hwy 99. Mostly this hawk flies medium high and slow since the size of the points are mostly medium and

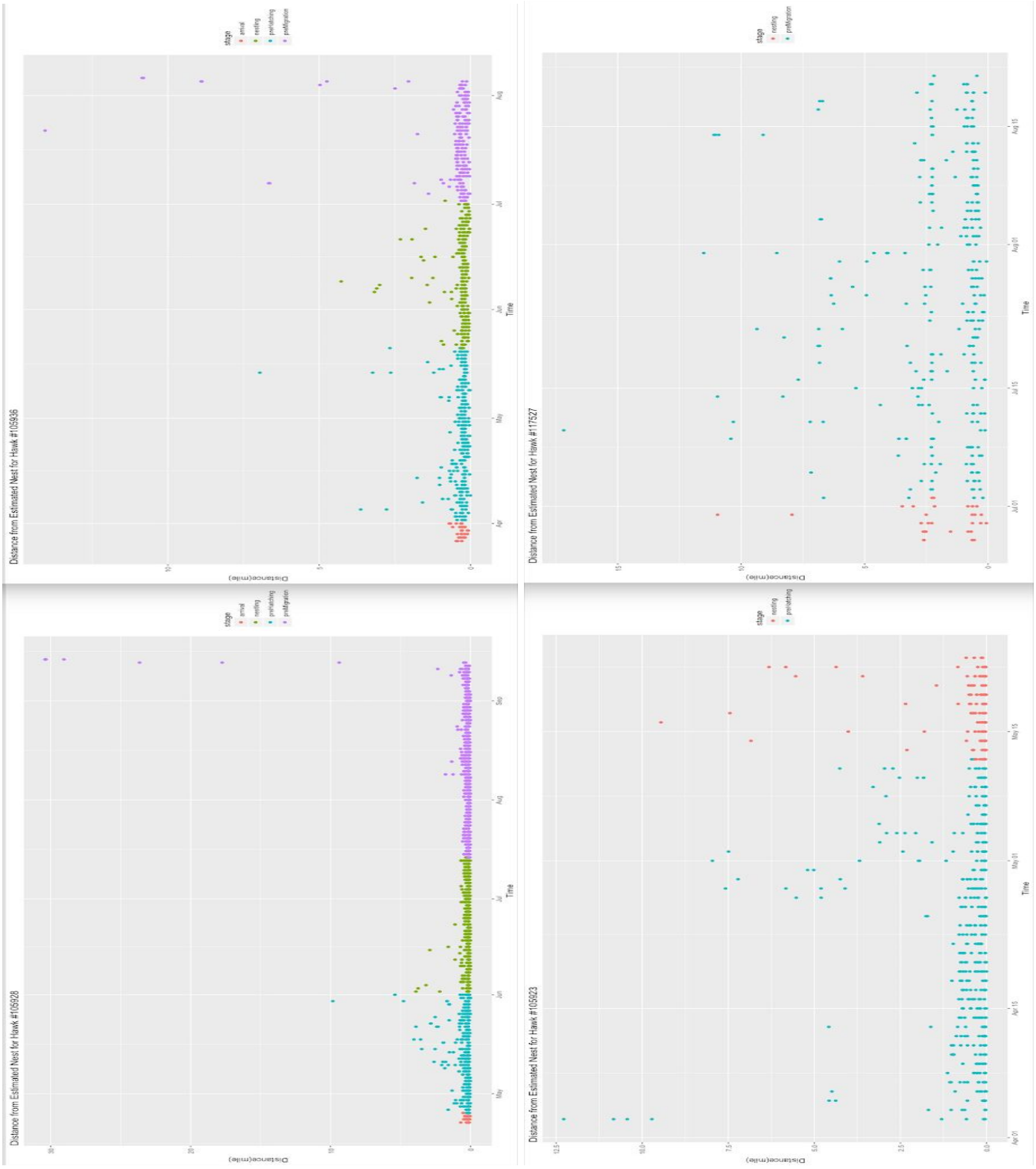
the colors are mostly dark. The green point shows the estimated nest for this hawk and it locates near Pacific Ave. The furthest from the nest this hawk flies to is with medium height and low speed.





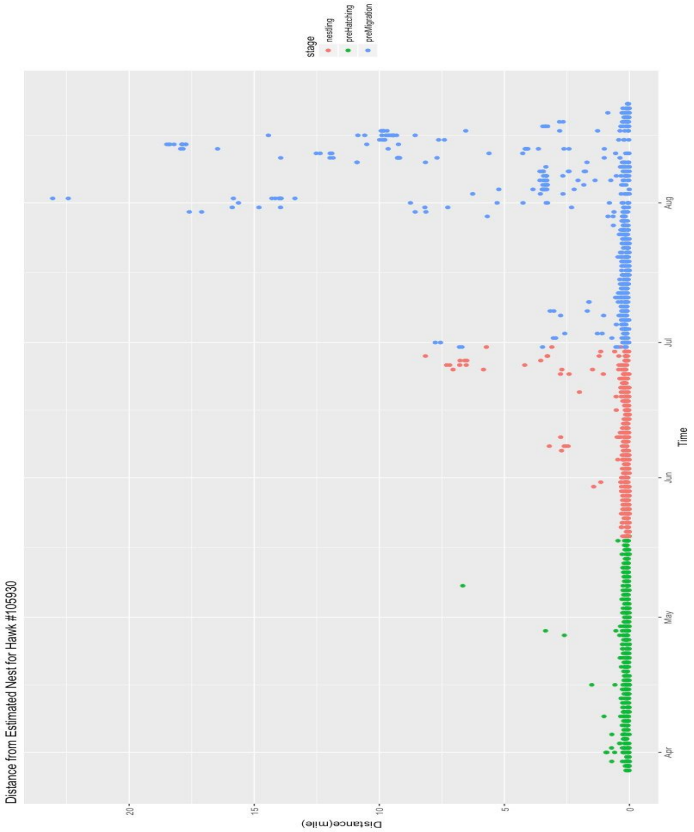
Q3:

The strategy to determine whether each hawk leaves their nest is: first, we determine the nests using median location for each hawk since median is not affected by outliers(locations that far away from nest). Then, we compare each location of the hawk to the estimated nest location and compute the distance in miles. Then, we use ggplot in R to visualize the distance from the nest at different time, for each hawk. The plots we got are as follows:



The last plot is attached in next page. In summary, by using R to plot the distances from estimated nest for each hawk and looking into the cutoff distance 5 miles, we found that for the newest time, hawk #105928 and hawk #105936 are recorded with large distance, meaning that they leave their nests forever after the premigration stage. Other hawks are

likely to stay in their nests at least until the time we recorded. We found these trends because we compare the distance from the nest for the newest time, if the hawk leaves its nest forever, the distance from the nest would be large on those latest days. Looking into each plot carefully and the leaving time outputs in R, we can even conclude more on these hawks living.



For example, in this plot for hawk #105930, with the leaving time output, we notice that this hawk has record until 2012-08-23 and it flies over 5 miles from nest only some days in August but not the latest days, meaning that it comes back and doesn't leave the nest. And we notice that in its preMigration stage, it flies over 10 miles for many days probably for preparing the migration.

In plot for hawk #117527 and the output, we notice that this hawk leave the nest over 10 miles a lot but it doesn't leave at the latest time, meaning it stays in its nest after the preMigration stage.

Same situation for hawk #105923, it doesn't leave nest for the latest days, and it leaves far away over 10 miles at the beginning of preHatching stage, meaning it flies far because of the adjustment to preHatching. At many days in May, it flies over 5 miles from nest in nestling and preHatching stages.

Hawk #105936 and hawk #105928 leave their nests forever because they are recorded located far away from nest in days at the very end of preMigration stage. In plot for hawk #105936 and output, we have records until 2012-08-06. Mostly we observe this hawk within 5 miles from nest since April except on 05-14 and 07-07 it leaves over 5 miles probably for adjusting itself from preHatching to nestling stage and from nestling to preMigration stage. And the time interval for this hawk to leave the nest forever is recorded from 08-05 8pm to 08-06 2am.

In plot for hawk #105928 and output, we have records until 2012-09-14. Mostly we observe this hawk within 5 miles from nest since April except on 05-30 and 06-01 it leaves over 5 miles probably for adjusting itself from preHatching to nestling stage. And the time interval for this hawk to leave the nest forever is recorded from 09-13 8pm to 09-14 3am.

Q4:

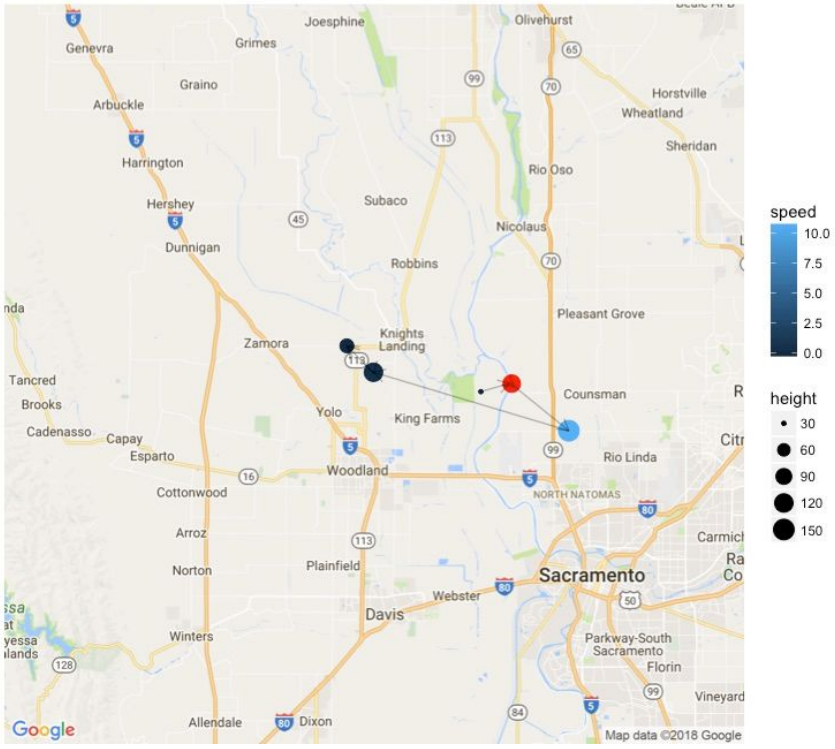
The following spatial maps show the departure sequences of the hawk #105936 and hawk #105928 since they are the only two who leave nest forever.

In the spatial map for hawk #105936, we see that the red point represents the estimate nest and this hawk leaves from its nest first to the light blue point where it is in south Counsman near Hwy 99 in high speed and high height, then it flies to Kinights Landing with high height and low speed, then start flying lower in height with the similar high speed. It seems that this hawk is migrating from the southen east of the estimated nest to Knights Landing where it is to the west of the estimated nest.

In the spatial map for hawk #105928, we see that the orange point represents the estimate nest and this hawk leaves from its nest first to the south of its nest to the direction of downtown Sacramento in low speed and low height, then it flies to the west of downtown Sacramento in high speed and low height, then to its following south with low speed and

high height to the area on Hwy 84, and from there to the middle of Elk Grove and Davis in high speed and low height, and finally flies directing to near Dixon in high speed and low height. It seems that this hawk is migrating from the northern Sacramento to the southern west Sacramento and continue migrating towards Dixon.

Here leave the hawks 105936



Here leave the hawks 105928