ESM 232 Assignment 2

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Summary of Findings:

Changes in temperature and precipitation caused by climate change have the potential to negatively impact agricultural yields of perennial crops like almonds. To understand the impact of these climate factors on almond yields, Lobell et al. (2006) developed statistical models that calculate almond yield anomaly as a function of mean February minimum temperature (in ºC) and total January precipitation (in mm). Using that equation in a function in R, the almond yield anomaly was calculated for sample climate data from 1988 to 2010. The results are shown in the table and figure above. Almond yield anomaly tends to be the largest in years where the total January precipitation is highest. Each of the peaks in almond yield anomaly occur when January precipitation is at least 200mm, and the greatest yield anomaly (1919.98 tons/acre) occurs in 1995, the year with the greatest precipitation (676.51 mm). Mean February minimum temperature also impacts almond yield anomaly, but not as much as precipitation does. Generally, lower temperatures result in smaller almond yield anomalies, as nearly all the 7-8 ºC temperatures result in anomalies around 0 tons/acre. Higher mean February minimum temperatures may result in greater almond yield anomalies, but 1996 shows that high temperatures may result in low yields if there is little precipitation. These results will be important in predicting how climate change may affect future almond yields in California.

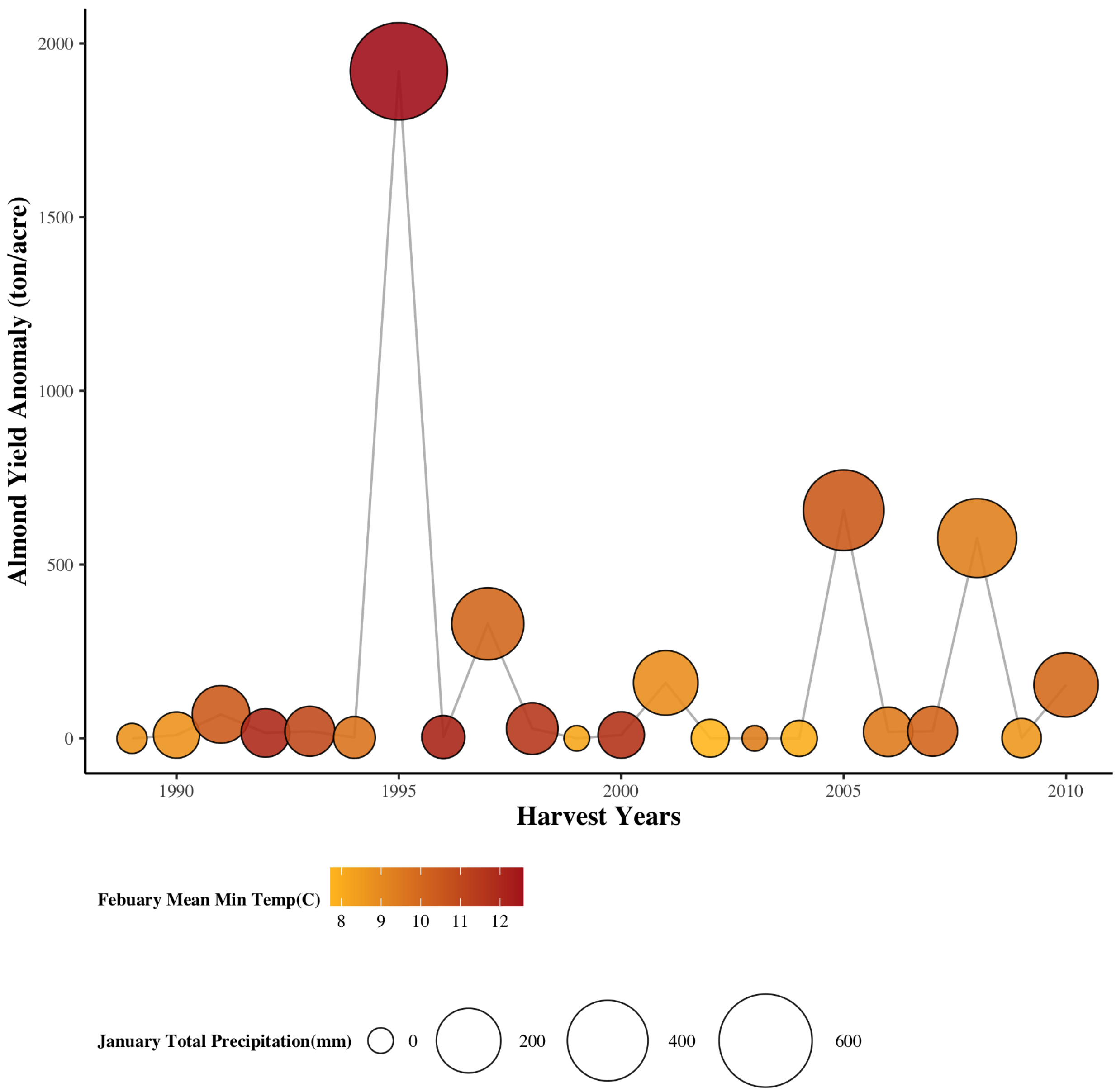

Figure 1: Fig. 1. Predicted almond yeild anomaly for each harvest year. Each year's mean temperature in February is the color of each circle, and the cumulative precipitation in January is represented by the size of each circle. Predicted almond yeilds are calculated based on temperature and precipitation according to Lobell et al., 2006.

Year	Febuary Mean Min Temp(C)	January Total Precipitation(mm)	Almond Yield Anomaly (ton/acre)
1989	8.640417	2.798	-0.3552237
1990	8.681270	55.812	9.2906757
1991	10.391468	135.337	68.9130633
1992	11.908525	69.640	15.4280698
1993	10.939464	77.903	20.2083803
1994	9.623710	34.804	2.4820009
1995	12.586270	676.512	1919.9811511
1996	12.040460	40.252	3.5818399
1997	9.988571	285.296	329.6938750
1998	11.484643	89.762	27.8636956
1999	8.103690	0.000	-0.1436364
2000	11.614732	57.318	9.5999883
2001	8.822143	201.041	159.5119587
2002	7.719107	20.338	0.2450914
2003	9.312381	0.000	-0.2585997
2004	7.889272	14.478	-0.2367722
2005	10.423869	399.034	656.3724121
2006	9.374365	74.930	18.6324135
2007	10.046329	77.724	20.2007396
2008	9.239175	374.396	576.2821943
2009	8.556669	24.892	0.7367438
2010	9.894963	197.612	153.7655092

Figure 2: Table 1. Yearly predicted almond yeild anomalies calculated from Lobell et al., 2006, plus the two predictor variables for each year, February minimum temperature averages and January total precipitation. Darker colors indicate higher values (higher average minimum temperatures; higher total precipitation; higher almond yeild anomalies)