1. PDF submitted separately.

2. Formal Write-up:

a) The issue that we investigated was soil compaction on Sonoma State's Campus. We were originally interested in researching groundwater recharge on campus due to the current drought. Unfortunately, we were unable to find an exact way to measure groundwater recharge. After further research we learned that the density and porosity of soil has a large impact on the amount of water able to seep through the surface level of soil and into the water table. Our study is relevant because the drought in California affects all of its residents as well as the entire country because California is a major center of agriculture. By having low soil density levels we can help to increase groundwater recharge.

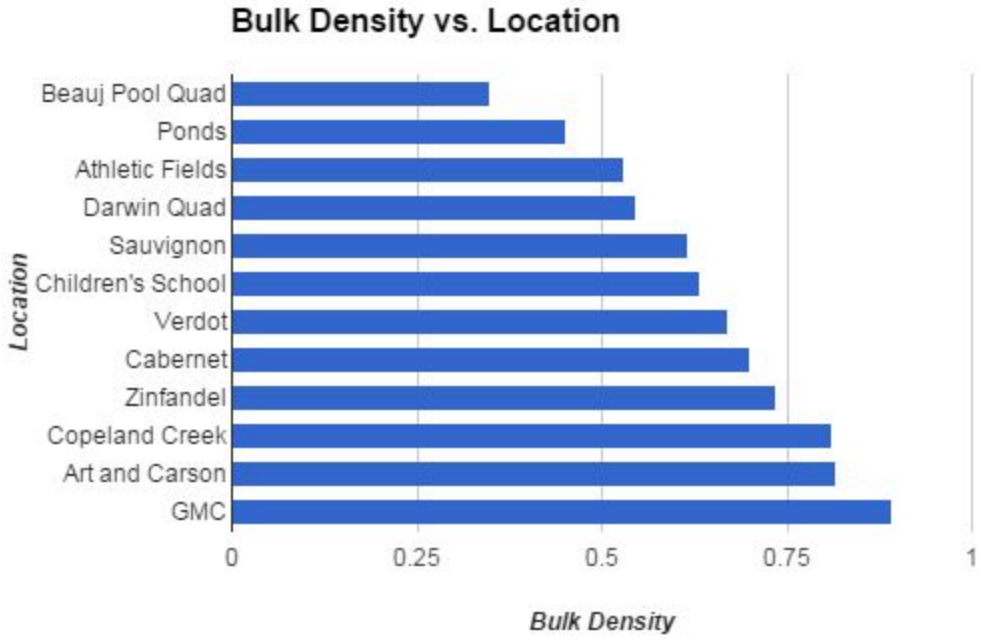
b) Although the drought has depleted our groundwater supply, we have continued pumping water from the ground. Over pumping of groundwater in California has led to the loss of over 80 million acre feet of land since 1962 (Stevens). Over pumping of groundwater as well as industrialization and and infrastructure have increased levels of soil compaction. Compact soils provide less space for root growth, seedling germination, and groundwater recharge. Soil compaction is tested by measuring the bulk density of a soil sample.

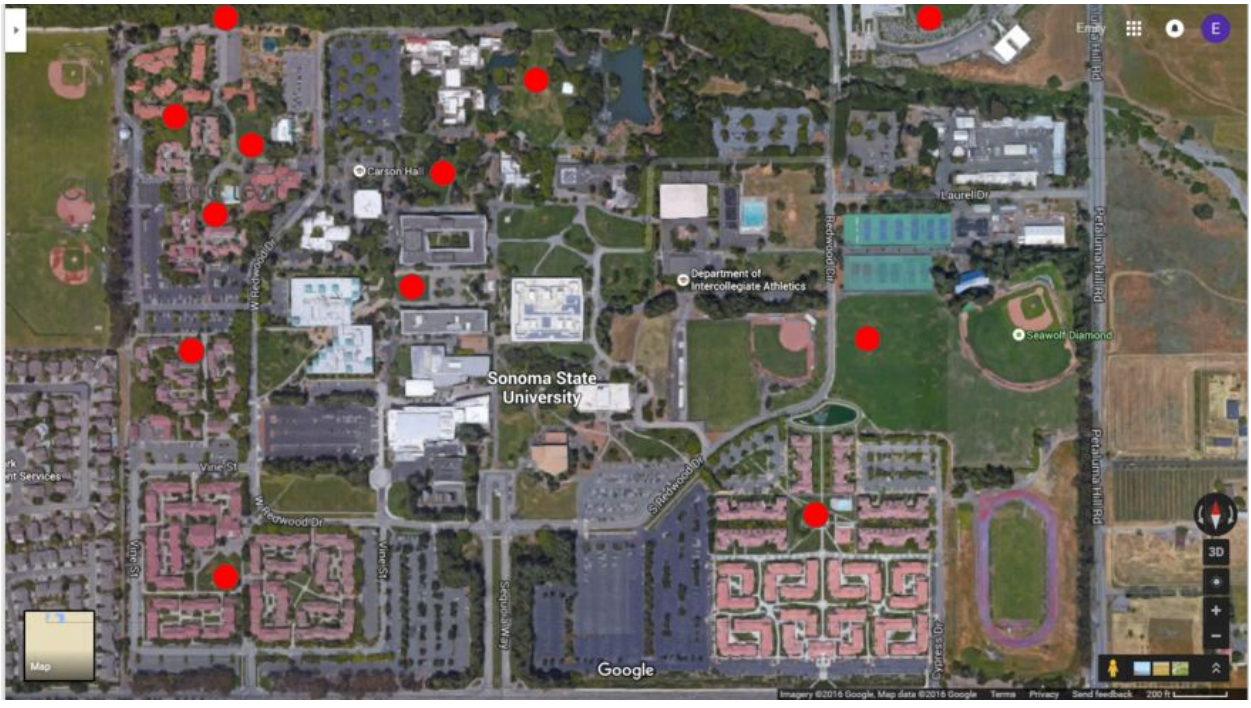
c) Methods/Procedures

- Duration of Study: 2 weeks
- Materials: 3 inch metal ring
  Hammer
  Microwave
  Sample Bags
  Scale
  Ruler
  Calculator
- Community Partners: We collaborated with Vanessa Dodge, a graduate student in the Geology department who is studying soil compaction in Tamales Bay. Vanessa was very helpful by meeting with us and providing us with plenty of information and materials for our project.
- Methods:
  1. Take 3 inch metal ring and hammer it fully into the ground, so it is level with the top of the soil.
  2. Remove soil from metal ring and place in a labeled plastic bag.
  3. After sampling all 13 locations, the soil samples were individually tested.
  4. The test involved microwaving each individual sample in 2 minute increments to dry out the soil samples.

5. After being dried the soil samples were weighed.

6. This process of microwaving and weighing occurred as many times as necessary for the soil weight to remain constant signaling that the soil sample was completely dried.
7. Once the weight was constant, the bulk density of the soil sample was calculated by dividing the weight of the sample by it's volume.
8. This was performed for all 24 samples. All samples were collected and measured within 12 hours.





d) The data that we acquired from our research shows various levels of soil density across Sonoma State University. The lowest bulk density we found was at the Beaujolais Pool Quad with a bulk density of 0.348 g/cm³ and the highest was at the Green Music Center with a bulk density of 0.893 g/cm³. Approximately 0.50 g/cm³ separates these two sites, however this is not concerning because all of our measurements are within desirable levels of compaction (below 1.5 g/cm³).We can conclude that Sonoma's campus has a desirable level of porosity to allow for groundwater recharge. The only spot that could be considered compacted is the old track, which was so hard that we could not obtain a soil sample from it. The old track however, is a small part of the campus and does not affect the soil compaction of campus as a whole. \

e) Dexter, J. (2011, July). Land Use Tools to Protect Groundwater: Preserving Recharge. Retrieved from http://elpc.org/wp-content/uploads/2008/06/ELPC-Land-Use-Tools-Part-2-Final-July-2011.pdf

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