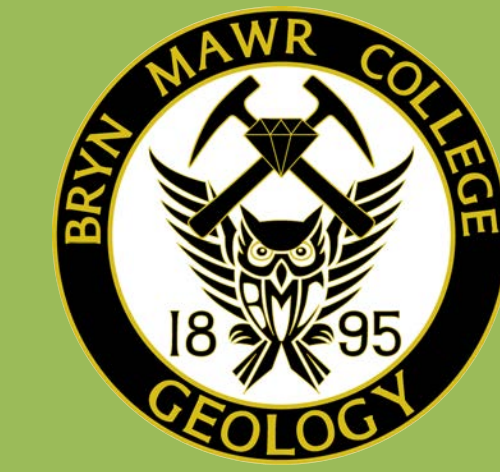


Using statistics to further study the impact of ditch construction in salt marshes



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Introduction

Research in 2020 has been different from any other year. What I imagined and what I ended up working on were very different as times changed and I could no longer work in the lab. Instead of collecting new samples to analyze in the lab I used data from my research last summer and worked with my mentor to discuss new ways to further analyze the data. The data came from my study of the effect of ditch construction on carbon storage and the resiliency of coastal salt marshes. My results from last year comparing carbon weight percent and carbon isotopic composition by core depth (Figure 1). We wondered if we could take this further by doing some sort of statistical analysis, so I spent the summer learning new methods to do so.

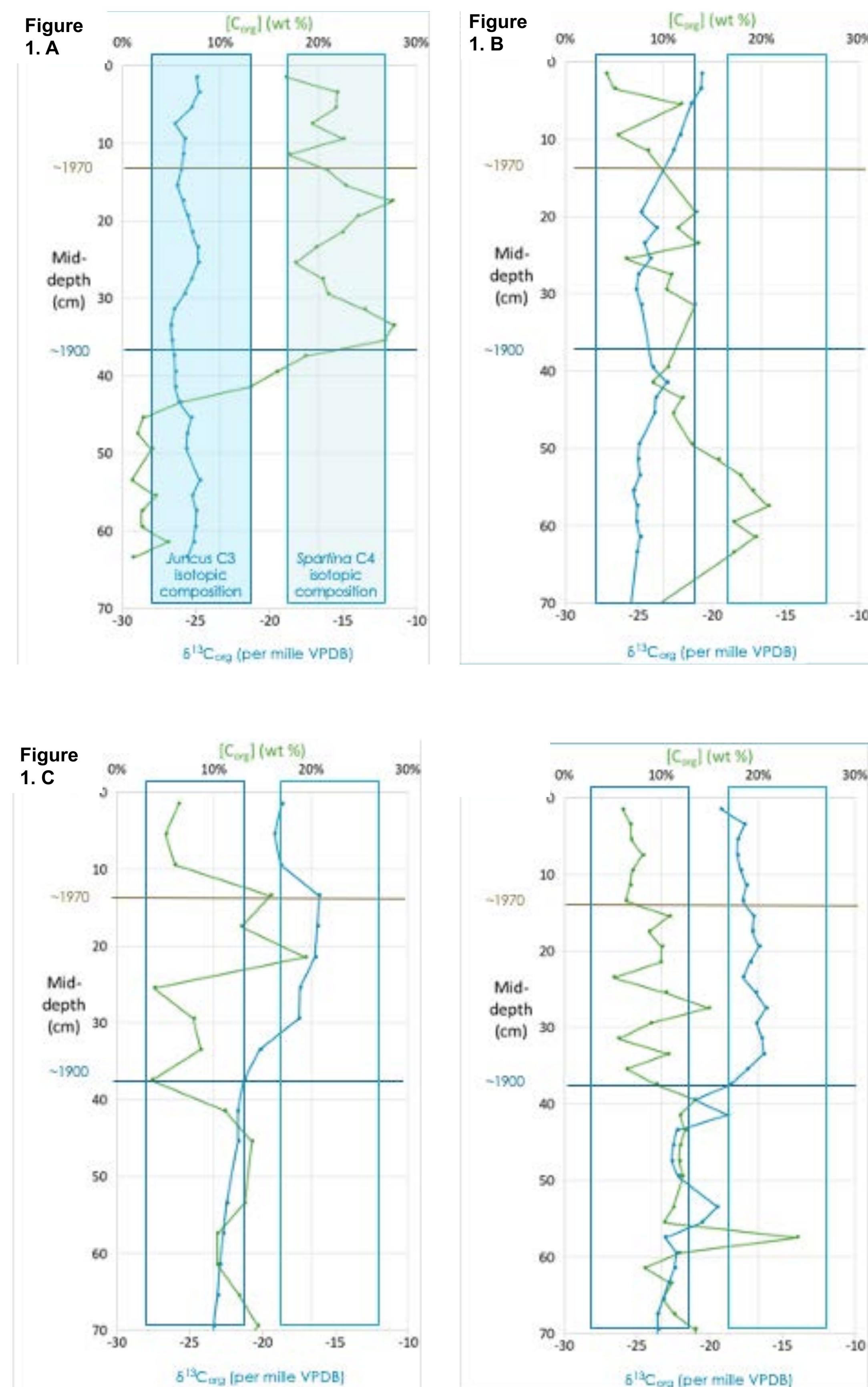


Figure 1(A-D). Show graphs of carbon weight percent and carbon isotopic composition by depth for four cores from two sites. A) This core is close to the coast land at the site without ditching. Its name is SM1901. B) This core is more inland at the site without ditching. Its name is SM1904. C) This core is more inland at the site with ditches. Its name is DI1703. D) This core is close to the coastline at the site with ditches. Its name is DI1707.

Methods

In order to analyze the data further I needed to up my skills and experiment with computer programs. I used to excel to organize all the data into neat columns that could be used later. Some of the tools I used to learn are Codecademy, Linkdin Learning, and Youtube. I used Linkdin Learning to get an introduction to how to begin with R, but then I branched out to using other tools for more specific tutorials. YouTube proved to be a useful tool for learning new things about excel that I didn't know before. I also searched the internet for tools to learn R so I could do some statistical analysis. There are a lot of free videos and websites that I found useful for learning this. I made box plots in excel and R as well performing t-tests in R.

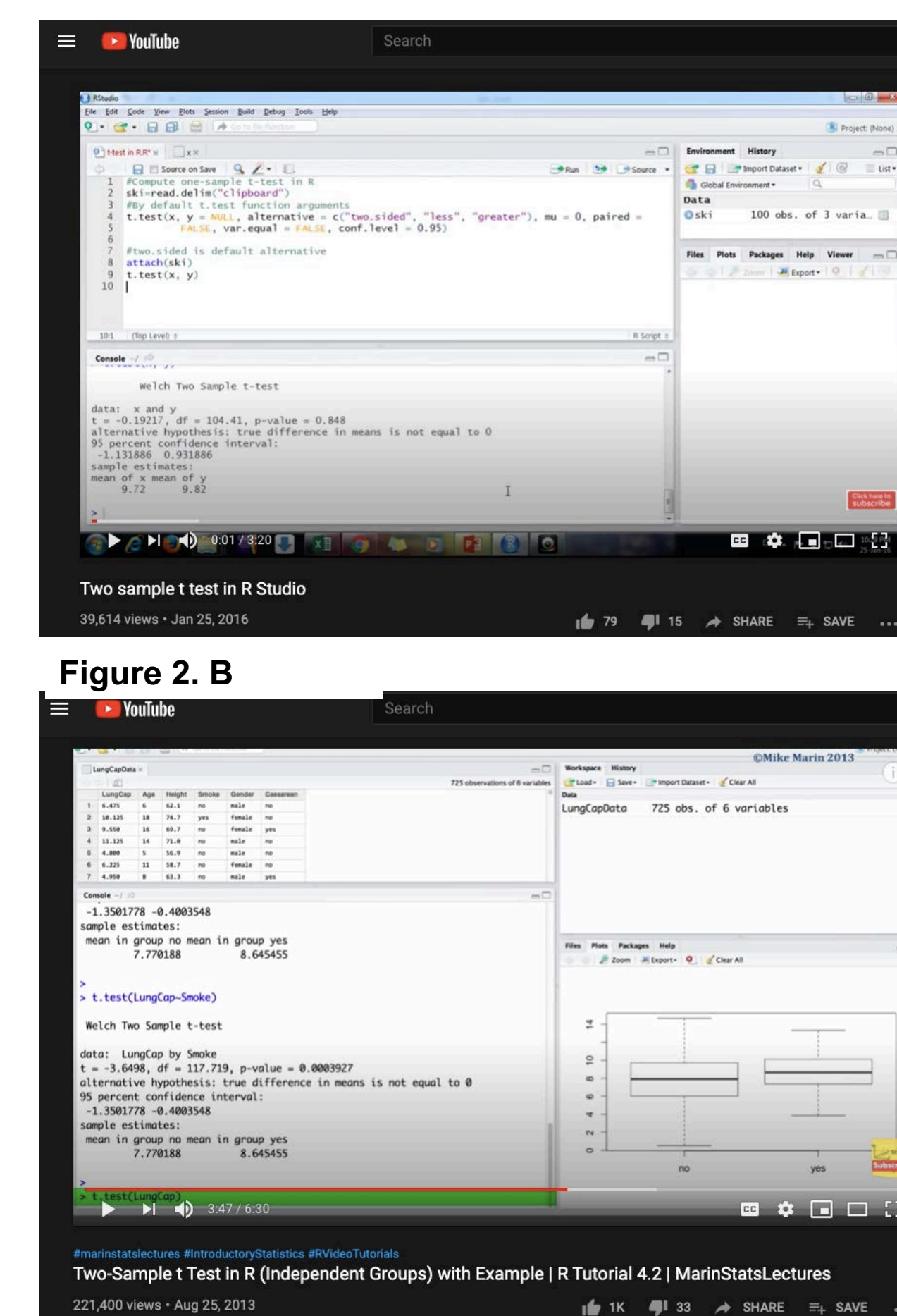


Figure 2(A-B). Screenshots of two of the videos I found useful in learning how to use R to do statistical analysis. Both of the videos explain how to do t-tests in R.

Reflections

This summer I learned that teaching yourself a programming language is possible with internet access, however I could not accomplish as much as I would have liked given the circumstances. Because I had no cohort, I ended up feeling very isolated. Normally I would have worked with other students and we would have learned together and helped each other but that was not possible this year. Learning new things in an ongoing crisis is difficult, but possible. I was able to obtain some results, but this summer was just the beginning in my journey to learn R and use it in analysis. This summer was useful for adding skills to my tool belt for future research projects and starting further analysis of my data.

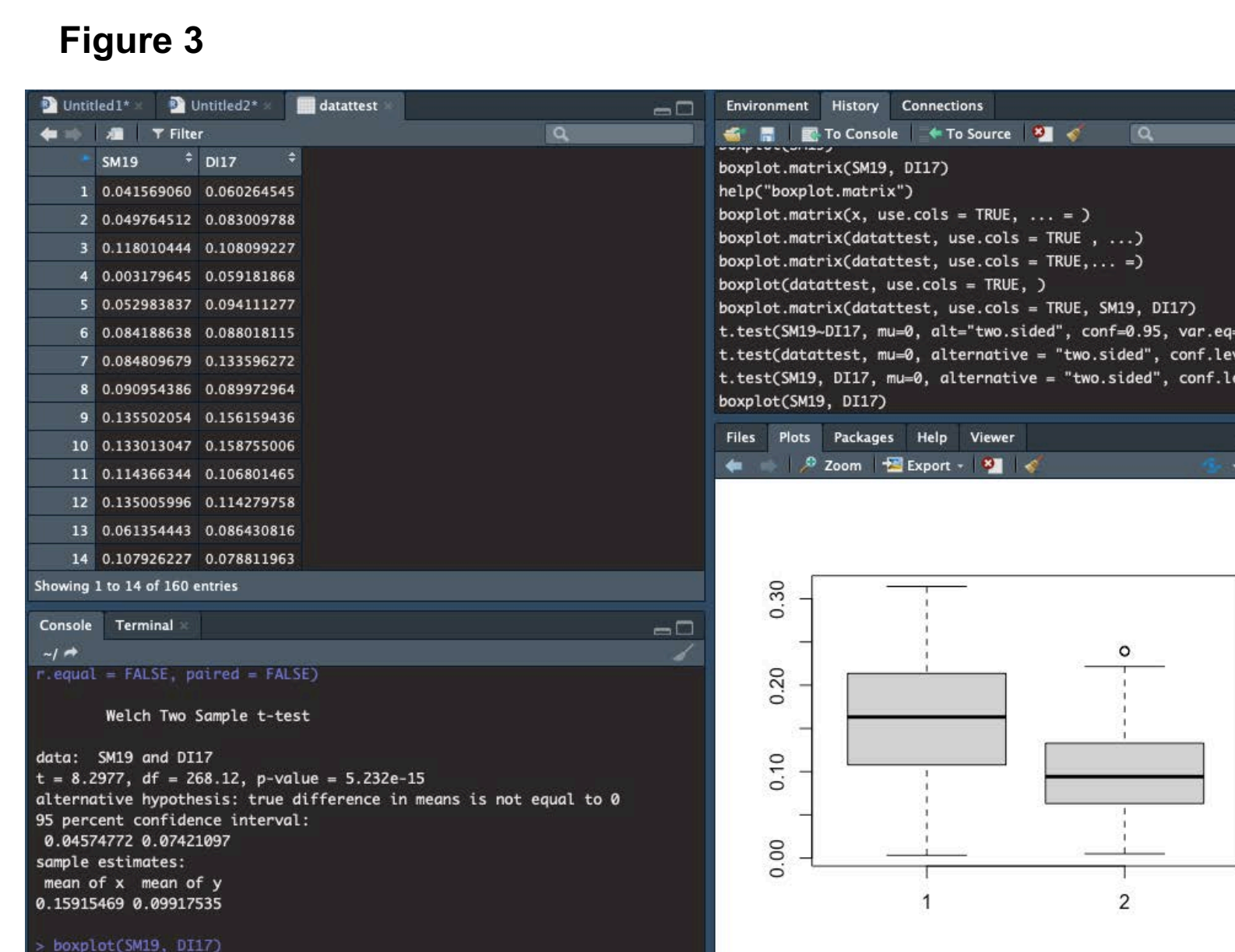


Figure 3. A screenshot of R studio with the results of a t test comparing the carbon weight percent of all the cores at Stacey Marsh (unditched) and all the cores at Davis Island (ditched). The top left corner shows a table of the values, the bottom left corner shows the results of the t-test, and the bottom right corner shows a box plot comparison.

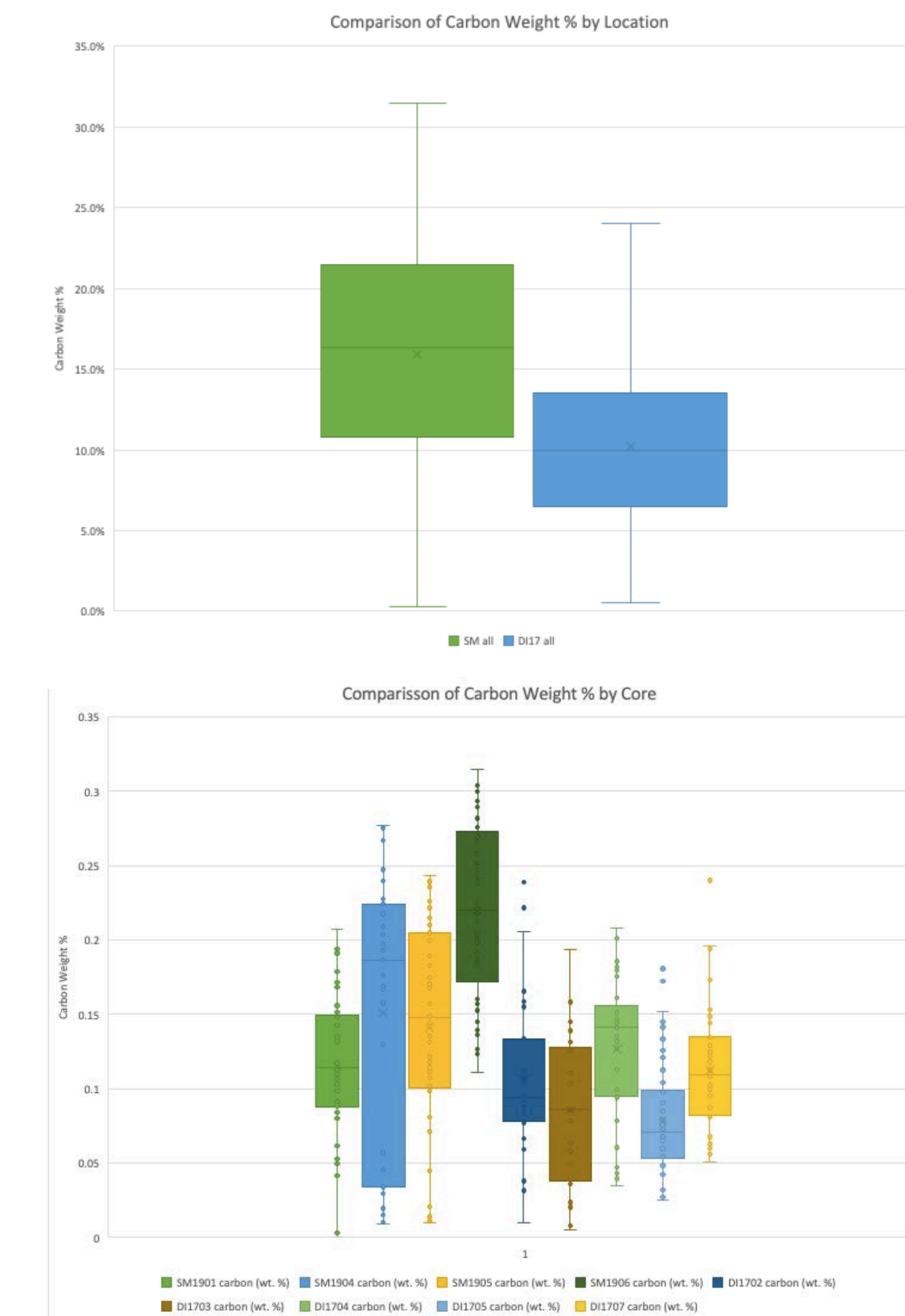


Figure 4(A-B) Box plots in excel comparing carbon weight percent of different locations. A) Shows a comparison of all the cores at the unditched marsh ('SM all' in green) and the ditched marsh ('DI all in blue'). There is a lot of overlap in the plots.

B) Shows a comparison of all the cores at the unditched marsh and the ditched marsh but is further split up by each core taken at each of the sites. The title of the cores are shown in the key. The ones with SM are from the marsh without ditches and the ones labeled with DI at the beginning are from the ditched marsh.

Conclusions and Discussion

The difference in carbon weight percent between the ditched marsh and the unditched marsh is statistically significant. Box and whisker plots of the carbon weight percent values from all the cores we took from Davis Island and Stacey's Marsh show a difference, but with a lot of overlap. However, further analysis shows that the means of the two sets of cores are different. To figure this out I did a t test at a 95% confidence level and found a p value of 5.232e-15 which is extremely small. This means that there is a true difference in the means of the carbon weight percent of the collection of core data from the two locations.

Beyond this summer more t tests should be done to further analyze the differences between the cores. I am interested in doing more t-tests to see the differences between cores from the same marsh but from different lengths from the coastline.

References

- Howard, J., Hoyt, S., Isensee, K., Pidgeon, E., Telszewski, M. (eds.) (2014). Coastal Blue Carbon: Methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows. Conservation International, Intergovernmental Oceanographic Commission of UNESCO, International Union for Conservation of Nature. Arlington, Virginia, USA.
- LinkedIn Learning
- Dr. Sarveshwar Inani. (2016, January 25). Two sample t test in R Studio. YouTube. https://www.youtube.com/watch?v=yF9_SQ8m698&t=1s
- MarinStatsLectures-R Programming & Statistics, M (2013, August 25). Two-Sample t Test in R (Independent Groups) with Example | R Tutorial 4.2 | MarinStatsLectures. YouTube. <https://www.youtube.com/watch?v=RihNnbPZCOA&t=228s>

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