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DSAM Capstone

Digital Tools for Historical Analysis and Pedagogy: A Reflection

In the summer of 2021, the *Journal of Social History* published a special section titled "Arguing Digital History." In this section, Stephen Robertson and Lincoln Mullen outlined the trajectory of digital tool usage in historical scholarship. Robertson and Mullen noted that "Digital history has only rarely created interpretive or argumentative scholarship in the ways that currently define both the forms and the ends of disciplinary practices of research."[1] Instead, digital tools have been utilized primarily for either methodological publications or as accessories to published texts. In the majority of cases where digital tools had been used for interpretation or argument, the projects were either public facing, published using nontraditional methods, or both. In more "traditional" publication methods, which Robertson and Mullen referred to as journal articles and books, the interpretation and argumentation has been largely absent. However, the two argued that this is beginning to change, with more historians beginning to utilize digital tools interpretatively in books and articles. Overall, Robertson and Mullen use the article to encourage more historians to start thinking about the value of digital tools for interpretative scholarship.

It wasn't until recently that I came across Robertson and Mullen's article, but their argument crystallized many of the feelings I had about my own digital work but had yet to effectively put into words. While I have not reached the point of consistently using digital tools to interpret or argue, I believe that I have gained the skills necessary to do so. My time in the

[1] Stephen Robertson and Lincoln Mullen: "Arguing with Digital History: Patterns of Historical Interpretation," *Journal of Social History* 54, no. 4 (2021): 1005.

DSAM program has helped me to think critically about digital tools and methods, to incorporate digital tools in my own work, and to learn how to teach using digital tools. But my experience in the program has also helped me realize how much more I need to do before I am satisfied with my use of tools and methodologies drawn from the Digital Humanities.

This reflective essay is my written journey through the DSAM certificate. I walk through each of the classes I took as part of the program, highlighting insights I gained from these courses, the projects I completed for them, and takeaways from each of these experiences. Along with the DSAM Seminar, Practicum, and Capstone, my electives were World History Methods and Environmental Modeling. All of these classes together shaped my conceptualization of the Digital Humanities and led me to more effective uses of digital tools, particularly GIS mapping, both in my research and pedagogy.

World History Methods

Ruth Mostern's "World History Methods: Digital Methods for the Spatial Analysis of the Past" introduced me to many of the concepts, themes, and tools that I would continue to utilize throughout my time in the DSAM program. One of the first lessons I took from the course was the importance of understanding the intended audience of a digital tool. As part of the course, Ruth had us explore various platforms and tools for spatial data and analysis and create a taxonomy of our choice based on these tools. These included Carto, ESRI Story Maps, Palladio, and StoryMapJS. Having to create a taxonomy led me to think critically about why these tools were created, which brought me to the question of audience. The audience the tool's creators had in mind, whether academics, businesses, or the public, shapes the design choices that are made.

This is something I continued to keep in mind as I reflected on my own digital projects as well as others' as I progressed through the program.

The course was also my first introduction to the theory and practice of Historical GIS. Anne Knowles' *Placing History: How Maps, Spatial Data and GIS are Changing Historical Scholarship* and Ian Gregory and Paul Ell's *Historical GIS: Technologies, Methodologies and Scholarship* were essential to my understanding of the best practices behind Historical GIS and the challenges that come with it. These highlighted many of the challenges that come with Historical GIS projects, including incorporating time into GIS analysis, how GIS can lead to a chronological view of history based on the specific data that is suited for GIS projects, and that to effectively use GIS, a historian needs to learn geographic skills in addition to the technical skills of the program. I also found Gregory and Ell's separation of GIS and mapping fascinating. The two note that while GIS and mapping are fundamentally intertwined, GIS is based around points, lines, and polygons, while traditional cartography allows for greater freedom in the design choices you make. While I am not convinced I fully understand the point they are making with this differentiation, it has at least led me to think more critically about what GIS allows for representation of.

My specific project for the class focused on Jamaica's banana and sugar industries, exploring the specific geographies of each crop within the island. In particular, it examined how the acreage of sugar and banana production in Jamaica shifted on a parish (Jamaican local government unit) to parish basis from 1896-1906. After exploring the various mapping platforms as part of the course, I decided that ArcMap was the best platform for my project due to the ability to create choropleth maps. Although I had never used ArcMap to create choropleth maps, my previous experience working as part of a GIS project in my undergraduate years, combined

with the two weeks of workshopping ArcMap in class, gave me confidence that I would be able to effectively use the program to explore the development of Jamaica's banana and sugar industries. Fortunately, due to my previous work on Jamaica, I already knew where to obtain my statistical data. Every year, Jamaica's colonial civil service office published a several hundred page overview of all activities and statistics from the island, called *The Handbook of Jamaica*. These handbooks included tens of pages on agricultural production on the island. This data included tables which showed the amount of acreage of different crops under cultivation on a parish by parish level. With the ability in ArcMap to examine findings at a parish level, this data provided the perfect fit.

Once I had my platform and data, my next decision came in how to approach showing the data. I decided to show the data in two forms: comparing the acreage of sugar and bananas cultivated based on total acreage and by showing the percentage ratio of bananas produced compared to sugar. I chose these two different approaches as I was interested to see if each told a different story or whether it was coherent. Overall, I found that the story the maps told remained consistent across each method of displaying the data. For each of these approaches, I looked at 3 years, 1896, 1901, and 1906, in order to show snapshots of how both industries evolved over a ten year period that saw some of the largest changes to the banana industry with the formation of the United Fruit Company in 1899. These dates selected also had to do with the data available to me. The Handbooks of Jamaica only begin accounting for banana acreage starting in 1893, meaning that there is no information available in these particular sources for the first two decades of the banana industry.

The last and largest methodological hurdle I had to overcome was figuring out where to place the breaks in my data. The library's GIS experts spoke in favor of using the Jenks Natural

Breaks option in ArcMap, but my challenge then became how to use Jenks across a series of maps that all included different data. Had I used the Jenks breaks with each map separately, my breaks would have been different for each map, which would have skewed my findings. Instead, I merged all of my data into one column, created a shapefile with enough features to fit all of my data, and ran the Jenks model, providing with me with the natural breaks based upon all of my data. I feel that this method gave me the best opportunity to compare my findings across time and crops without arbitrarily assigning break points. Once I had these breaks created, all that was left to do was create the maps themselves.

Overall, the maps demonstrate that the growth of the banana industry was a regional phenomenon in Jamaica, with the growth in acreage taking place almost entirely in the eastern portion of the island. The island's sugar production, which was focused primarily in western Jamaica, remained relatively unchanged in the period from 1896-1906. These findings pushed me to think more critically about the relationship between sugar and bananas, as the two crops have clearly different geographical centers, something I was unaware of prior to creating these maps.

Thinking about this project in the context of the class, while not world historical in scope, the project does speak to understanding the importance of scale when thinking about any historical project. As Geoff Cunfer discussed in "Scaling the Dust Bowl," "varying scale can dramatically alter our understanding of the past." With Jamaica being a relatively small island, it is easy to think of the island as one coherent unit of space. Thinking along these lines can lead to examining the island's sugar and banana industries in the same way, as both encompassing the entirety of the island in a similar way. However, as previously mentioned, the findings from this project reveal two very different geographical centers for the sugar and banana industries.

Looking at the industries from a parish level rather than island level led me to begin to think differently about how the two industries evolved on the island.

DSAM Seminar

Moving into DSAM 3000 in Fall 2018, I knew that I wanted to continue working with GIS to see what the program had to offer and how I could use the tool to benefit my own research. My main questions going into the course were based around figuring out what the geography of the banana industry was in twentieth century Jamaica and how it was impacted by Panama Disease, a fungus that infected and killed banana plants and resulted in the near extinction of the original commercial banana variety, the gros michel. One area in particular that I wanted to explore was how mapping the geography and the spread of Panama Disease could help in understanding the factors that led to the spread of the disease. I knew I did not have enough data yet to map the spread of the disease itself, but I knew from some of my previous research that the *Handbook of Jamaica* contained data for specific banana plantations on the island. With this in mind, I decided that the closest I could come to seeing the spread of Panama Disease, at least on plantations, was to reverse engineer it, mapping places where banana plantations popped up and disappeared. With the available data on Hathitrust, I decided I wanted to look at 1896, 1906, and 1916, which showed the industry prior to the creation of the United Fruit Company, the industry before Panama Disease, and the industry after planters first discovered the disease on the island.

Overall, moving through the course and working on my project highlighted that the data collection, management, and cleaning side of a GIS mapping project should take the vast majority of the focus. The ArcGIS platform itself is just the final visualization of that data. Most

of my time spent in the class centered around how to obtain my necessary data. Much of this meant finding the latitudes and longitudes of all of the island's banana plantations. The handbooks only provide the name and parish, with no information about where exactly these were located. I spent quite a bit of time trying different methods to figure out these locations. I ended up using the University College of London's Legacies of Slave-Ownership website. You can search by estate name and colony and it will show the plantations that match that name, the parish, and then plots the point on an OpenStreetMap inset. The data only runs through emancipation in 1834, but most banana plantations were originally sugar plantations, so I was largely successful in finding the banana plantations through the site.

Another portion of the class was spent figuring out how to work with HathiTrust "capsules" that would theoretically allow me to access data still under copyright. This would have required scraping the data using a tool such as Voyant, Anaconda, R, and Scala among others. As I had no previous experience using any of these programs, nor experience with a programming language, I spent several weeks learning how to operate these various platforms. Through this process, I learned how to examine word correlations in Voyant, create a bar graph of banana cultivation by parish using R, and to make Scala say "hello world." In the end, none of these tools brought me closer to figuring out how to get my data from Hathitrust, but I learned quite a bit about programming, statistical tools, and topic modeling through this exploration of tools. And this first foray into R would help me in the following semester as well.

With this Hathi-Trust dead-end reached, I returned to figuring out how best to use the data I had access to. I decided to focus my work on a comparison of banana plantations between 1917 and 1922 to see if I could locate any differences in plantation size and locations between these years. After creating QGIS maps for both years, it appeared that the parishes with the

largest drop offs were Portland and St. Catherine. Portland made sense since it was the parish where the disease was first discovered, making it ground zero in terms of the potential spread of the disease. St. Catherine, however, is not adjacent to Portland or connected by any rivers. I was not sure why this parish in particular would see such a decline. Looking at the locations where there was the largest decline of plantations, I noticed that a number of plantations that stopped cultivating bananas in St. Catherine were located around the Rio Pedro River. Upon seeing this, I went to the online archive of the Daily Gleaner, Jamaica's primary newspaper, and keyword searched "Rio Pedro River" and "disease" from a period of 1912, when Panama Disease was first discovered on the island, to 1922. I looked through the results and saw that no one seemed to be talking about the river as a site of disease.

I then spent some time looking through the data and images I collected as part of my summer research in Jamaica and came across a map of the railroads and mail routes on the island in the early twentieth century. Looking at the map in relation to the digital maps I made, I discovered that the railroad line ran right through St. Catherine and the area around the Rio Pedro River. Upon seeing this, I searched and found a shapefile for the current railroad in Jamaica. The reason that I had not used this shapefile in my previous iterations was that I was hesitant to apply a contemporary railroad map to the early twentieth century. However, when I eventually did upload this shapefile to QGIS and compared it to the map I found over the summer, I noticed that the rail lines, at least for the eastern parishes, were identical. With the rail lines now in my QGIS maps, I looked around Portland as well to see if there is any seeming correlation between the location of the railroad and the decline of banana plantations. The rail line runs close to the coast in Portland, which is also where the largest decline in banana

plantations was, suggesting that there is at least the possibility of some relationship between the two.

Upon seeing this potential relationship between banana decline and the rail lines, I went back to some of the notes I had taken over the summer on the *Journal of the Jamaican Agricultural Society*. In the 1919 journal, one news bulletin brought up that people needed to stop loading banana trash onto rail cars. The rail companies would use the banana trash as a mat to protect some of the other goods being transported. The bulletin in the journal talked about the frustrations that the rail companies either were not posting these warnings or that people were ripping them down. As the banana trash, not just the plants themselves, were carriers of Panama Disease, there was concern that loading diseased trash onto the rail cars would accelerate the spread of the disease. This reference to banana trash and the changes evident in the maps I created led me to further explore the relationship between Panama Disease and banana trash, with this finding becoming a critical component of the second chapter of my dissertation. Reflecting back now, I feel that this use of GIS was the closest I came in any of my work to the interpretive and argumentative use of GIS.

DSAM Practicum

Moving into DSAM Practicum in Spring 2019, my goal was to explore other methods of analysis besides the GIS mapping that I had worked on in my two previous DSAM courses. I felt that I had made significant gains in my understanding of GIS mapping over the previous courses and did not want to just refine the same process over and over. Two topics that I decided to focus on were learning about digital approaches to and visualizations of soil properties and using spatial analysis tools in QGIS to explore sugar production within Jamaica.

I first chose to focus on soil properties. Based on my banana plantation mapping work in the fall, it appeared that there was a relationship between railroads and the spread of the disease. At this point, I wanted to figure out if there are any other relationships that are noteworthy, such as how soil properties could contribute to the spread of the disease. Having no knowledge about anything associated with soil properties, my first task was to figure out if anyone had done research into what types of soil properties are conducive to Panama Disease. I discovered Marianne Bosman's 2016 Master's paper at Wageningen University. Bosman conducted a field survey in Costa Rica to determine the relationship between incidence rates of Panama Disease and a variety of soil properties. Among her findings were that Panama Disease incidence rates are higher under alkaline (high pH) conditions, high aluminum leads to high incidence rates, high acidity has high incidence, low potassium and phosphorus lead to high incidence, and high magnesium has high incidence rates.

After finding this information, my next task was figuring out how to actually obtain any of this data for Jamaica. Because of the lack of historical data, I decided to focus on contemporary soil conditions for this initial foray. Through my searching I eventually found the International Soil Reference and Information Center (ISRIC) soil geographic databases. You can search their online database by country to see what data they have available. The database only holds two findings for Jamaica: the soil and terrain database for Latin America and the Caribbean and its associated parameter estimates.

After hours of frustration from not being able to make the data resemble anything coherent, I finally discovered that the data contained sub-shapefiles that can be joined to the primary shapefile for all of Latin America and the Caribbean. The main shapefile divides countries into several regions based on soil and terrain properties. The sub-shapefiles can then be

used to create color gradations for whichever soil property you wish to examine. I created a few of these categorizations, including for nitrogen, slope, and pH. After creating maps based off of this data in QGIS, my main takeaway was that I did not have a takeaway. The Shapefile divided Jamaica into five seemingly random regions, and I did not feel that the regions adequately accounted for much of the geography in Jamaica, especially the Blue Mountains. Additionally, I found the regions too broad to take meaningful results from them.

Overall, my journey with soil led me to two conclusions. First, I needed to conduct more research to figure out what some of the soil properties actually mean to determine if researching soil will be useful for me. I did not know enough about soil to attempt to use it in a meaningful way. Secondly, I left this iteration thinking that digital methods are probably not the best way to analyze soil in a historical context. Jamaica's soil has undergone significant changes between the early twentieth century and today, and I question whether modern soil maps adequately convey historical changes.

For my second iteration, I decided to look at the history of the sugar industry in Jamaica. As I did with banana geography, I wanted to see what the geography of sugar plantations looked like through mapping sugar plantation locations over a series of years in QGIS. Also as with the banana industry, no specific data on smallholdings is available so I had to rely on plantations to create a point-based geography. The Handbooks of Jamaica that I used to map the banana plantations also contain the same information (parish, acreage under cultivation, estate name) for sugar plantations on the island. I then had to type all of this out in EXCEL to put the material in a format readable by QGIS. After creating my spreadsheets for the years 1897, 1907, 1917, and 1922, I uploaded the files to QGIS. I ended up using a Jenks distribution to create my acreage breaks, using the same method I used in World History Methods. This provided me with

consistency across my four maps. After mapping the plantations, I compared these points to those of the banana industry, which shows how largely separate these two industries were from one another, with the majority of sugar plantations in western Jamaica and the majority of banana plantations in the eastern parishes. However, this is information I already knew, so having the map in this case did not provide much analytical value beyond visualizing this information.

After looking at the geography, I wanted to see how the total acreage of Jamaican sugar plantations changed over the years that I mapped (1897, 1907, 1917, and 1922). After adding up the plantation acreages for each year, I saw very little change over time. There were 25,347 acres of plantation sugar in 1897, 20,946 in 1907, 21,620 in 1917, and 22,842 in 1922. Seeing this, I was surprised at how little change there was between these years. However, I went back and looked at the change in overall sugar production, not just the plantations, between 1917 and 1922, the years where the banana industry began to see a large decline in acreage due to Panama Disease. For sugar, the total acreage increased from 33,830 to 53,794 acres between 1917 and 1922. This 20,000 acre increase corresponds to a similar acreage decline in the banana industry, which went from 78,485 acres in 1917 to 59,720 in 1922, a loss of about 20,000 acres. Comparing the increase in sugar acreage overall to the increase in sugar plantation acreage shows that only about 1,000 of that 20,000 acre increase came from plantations, meaning that roughly 95% of that growth came from smallholders. This revelation about smallholders was extremely helpful in shaping my dissertation, as it showed that the geography of where the sugar industry grew and where the plantations were located were two very different things

Although the sugar mapping was useful for shaping my thinking, it did not really introduce any new methodological tools into my repertoire. As a result, I decided to try to learn

how to use the spatial analysis features of QGIS. It took some time to debug QGIS, as the version I had installed initially had broken processing tools. After finally getting QGIS to cooperate, it opened up a new range of analysis tools for me to use. However, I have yet to find any that seem helpful for my research. One of the tools, Voronoi analysis, divides areas into cells, with each cell covering the region closest to a center. It is often used for determining where to place infrastructure such as post offices, as it shows the largest empty area among a collection of points. I just am not aware of a way that this would help with my capta. Out of all of the tools I explored, buffer analysis is probably the closest to useful for my project. With it, you can see spatial overlap between plantations that might facilitate easier movement. The main problem right now was that the buffer distances were based on degrees rather than latitude and longitude. I was unable to figure out how to make the shift. I left this iteration largely frustrated about my lack of success in incorporating spatial analysis tools into my GIS repertoire.

Environmental Modeling

I combined the final iteration for DSAM Practicum with the other DSAM class I took in Spring 2019, Environmental Modeling. I took this class for several reasons. First, I wanted to learn a tool completely separate from GIS. I had no previous experience with environmental modeling, and the only coding experience I had was my attempts to access the HathiTrust capsules. As a result, this was an opportunity to learn a new digital language. Second, I wanted to see if environmental modeling could be a useful tool for historical analysis, while at the same time expanding my interdisciplinary bonafides. While I came away from the class skeptical about the prospects of environmental modeling for historical analysis, particularly in the context

of my project, the class as a whole helped me to expand my overall knowledge about the potential uses of digital tools.

The final project for this class involved us making our own research-based model through coding in R. I initially proposed to create a banana plantation-complex model that incorporated climate, soil properties, and distances from rail lines, water, and other plantations as variables. Ideally, this would have shown how different variables contribute to the likelihood of Panama Disease infecting a plantation. However, I quickly realized that I did not know nearly enough about modeling or how to use R to make this plan actionable. Instead, I chose to focus on one specific variable, temperature, to see how different temperatures impact the rate at which the roots of a banana plant become completely colonized by the fungus that causes Panama Disease. I hypothesized that as temperature increases, the rate at which Panama Disease infects a plant increases, thereby decreasing the warning time planters have to quarantine infected plants. I further hypothesized that banana growing areas at higher altitudes will become infected at a slower rate due to decreased temperatures in these areas. As a result, the findings of this research may suggest that certain banana growing lands may offer better hopes of quarantine than others, which could potentially lead to shifts in both the geography of the banana industry and in who the predominant banana growers are.

In order to model the rate of Panama Disease growth within a banana plant, I used equations taken from “Linking Plant Disease Risk and Precipitation Drivers: A Dynamical Systems Framework (Thompson, et al. 2013). Thompson created what she describes as a “simple model of Pc infection in a plant root system based around root volume, the rate at which pathogen extent increases, the rate of root regeneration, temperature, and the ratio of infected versus uninfected roots. The resulting models showed the amount of time in days it takes for the

roots of an infected plant to become completely infected by a fungal pathogen. The differential equation used to show the development of disease within plant roots takes the form:

$$db/dt = b(rW) - m) - (b/v)n.$$

To obtain the values needed for the equations, I combined research Thompson conducted on pathogen growth in the southwestern United States with characteristics of banana plants. For the root regeneration (m), I used, as did Thompson, an assumed value of $m = 0.1$. In the equation, n is used as a constant for computational purposes and was set at $n = 100$. The volume of a banana plant root (v) was set based on prior research into banana root systems (Lecompte, et al. 2005) with a value of $v = 15$. In this equation, b accounts for the amount of the root volume that is colonized by a fungal pathogen. For this model, I worked under the assumption that the banana plants were just infected with Panama Disease, but that it did not have time to spread and grow yet. Therefore, I set the value of b at $b = 0.1$. The way that the effects of temperature enter the equation is through calculating the rW value, the rate at which the pathogen spreads. Because no research has yet been done specifically on bananas in terms of pathogen growth rate in roots, I used the equation provided by Thompson to calculate the rW value, which took the form: $rW = -0.1122 + 0.023T$ where T accounts for a given temperature.

To account for variations in space, I selected five locations within Jamaica at varying altitudes to use as the comparative basis. The low altitude locations I chose were in Portland, St. Mary and Westmoreland to provide spatial variation. The two higher altitude locations I chose were in St. Catherine and the Blue Mountains. Additionally, for a point of comparison, I selected the primary banana growing region in Ecuador as a sixth location to see how the climate of Jamaica compared to the world's leading banana exporter in terms of suitability for Panama Disease growth. To obtain the altitude for each coordinate set, I utilized the Advanced Converter

altitude map tool. Having these six locations allowed me to see how different temperatures at various locations and altitudes affects the speed at which a banana plant's roots become fully infected by Panama Disease.

Table 1: Locations Chosen for Study

Location	**Latitude**	**Longitude**	**Altitude**
St. Catherine, Jamaica	18.1267	-77.0696	365m
Portland, Jamaica	18.1905	-76.4749	95m
St. Mary, Jamaica	18.3348	-76.8904	32m
Westmoreland, Jamaica	18.2682	-77.9130	194m
Blue Mountains, Jamaica	18.1512	-76.6361	580m
Los Rios, Ecuador	-1.1711	-79.4849	37m

To obtain the temperature data for each of these locations, I used the MarkSim DSSAT weather file generator, a web-based Markov model tool that predicts the temperature and rainfall amounts at specific locations on a daily basis through the year 2100. To see temperature change over time for each of the six locations and how this could impact the speed of fungal growth, I selected the years 2020, 2050, and 2080 to be simulated for this study. The resulting temperatures after running the model can be seen in Table 2. To ensure some variability within the temperatures, I obtained the minimum and maximum temperatures for each location for the given years and used each range to make the temperatures used in the model stochastic rather than fixed.

Table 2: MarkSim Temperature Range Results

Location	2020 Temperatures	2050 Temperatures	2080 Temperatures
St. Catherine, Jamaica	21-35C	34-38C	33-38C
Portland, Jamaica	32-40C	34-40C	40-45C
St. Mary, Jamaica	30-40C	33-40C	40-46C
Westmoreland, Jamaica	32-36C	34-37C	35-37C
Blue Mountains, Jamaica	23-37C	32-38C	33-38C
Los Rios, Ecuador	32-37C	40-47C	40-45C

The model results show variation in the rate at which a plant's roots become colonized by Panama Disease in terms of both space and time. Looking first at the year 2020, each of these locations shows exponential growth of the pathogen beginning around day 11 and ending around day 12. For the year 2050, the three separate slightly, with St. Mary and Westmoreland plants beginning growth by day 10 and reaching maximum volume by day 11. Portland in contrast remained nearly the same as in 2020, except for reaching maximum growth slightly faster. For 2080, Portland and St. Mary's exponential growth shifted several days earlier, beginning by day 8 and ending by day 9. Westmoreland remained roughly the same as it was in 2050, beginning by day 10 and ending by day 11, albeit slightly earlier in day 11 than in 2050.

In contrast, the high-altitude locations in St. Catherine and the Blue Mountains showed a slower rate of spread than the low-altitude locations. In 2020, exponential growth did not begin in the Blue Mountains until day 15 and ended on day 16. In St. Catherine, exponential growth started on day 16 and ended on day 18, which is 5-6 days slower than in the low altitude locations. In 2050, root colonization took place significantly earlier, beginning in day 10 and ending in day 11 in both St. Catherine and the Blue Mountains. The projected growth for 2080

was nearly identical to that of 2050. As a point of reference to the five Jamaican locations, Los Rios, Ecuador in 2020 showed the same pathogen spread rate as the lower altitude locations, but for 2050 and 2080, shifted several days earlier, with exponential growth beginning on day 7 and reaching maximum volume on day 8. The results of this study suggest that due to a lower and wider range of temperatures, banana cultivation in higher altitudes offers more time to notice and therefore quarantine infected banana plants than those grown in lower altitude areas, supporting my initial hypothesis. Additionally, they show a degree of urgency in genetically engineering a Panama Disease-resistant variety of banana. In every location examined, the results for 2050 and 2080 show a sped-up process of infection of the plant root.

Overall, I would view my experience with environmental modeling more as a proof of concept that I can use these tools than something that was analytically useful for my dissertation. I included in this reflection the specific models and methods I used to create my project model to demonstrate how few of them actually relate specifically to Panama Disease, to Jamaica, or were grounded in historical data. There have been no specific environmental modeling projects based around Panama Disease, so the list of assumptions I had to make to adopt differential equations used for other disease spread models was very long. It would take me significantly more time to determine the validity of some of these models for cross-species analysis than was possible in the confines of a one semester class while I was simultaneously learning a new programming language and what environmental modeling was in the first place. I also found few environmental modeling projects that are historical in nature, which is unsurprising given the traditional uses for contemporary and future concerns. I did not know how to make these models work for a historical project, so I used my project to look forward to potential spreads of Panama Disease in the future. I found that the more I dove into the project, the further afield I went from

my own research interests into Afro-Jamaican smallholder agriculture in the context of Panama Disease spread. I came away from the class skeptical that environmental modeling would be an asset to helping me tell this particular story.

DSAM Capstone

As with many of my previous DSAM courses, my Capstone experience was based around several different projects, met with varying degrees of success. The three projects I focused on were creating and refining maps for my dissertation, looking into the possibility of creating a companion website for my digital work, and reflecting on and creating pedagogy based around tools drawn from the Digital Humanities. Combining all of these into one theme, I would say my overall focus was based around best ways to present digital tools and projects to a variety of audiences.

Discussing the maps first (all of which are viewable on my portfolio), I ended up creating fourteen GIS maps for my dissertation. All of these maps fell into one of two buckets: examining specific locations and acreages of banana and sugar plantations or choropleth maps showing parish-by-parish changes in banana or sugar production. All of these used the same Jamaica basemap. Reflecting on the value of these maps to my project, I feel that the maps that led me to a further analysis of banana trash were the most useful to my overall project. These pushed my research forward in ways that I don't think I would have gotten to without them. The other maps were useful for my project, such as for seeing who was able to practice shifting agriculture and at examining different geographies of sugar and banana cultivation, but these did not move my research forward in the same way that the banana trash maps did.

I contemplated making several additional maps that looked at the severity of disease spread across parishes, the decline of sugar plantations in the nineteenth century, and banana and sugar production in the 1930s and 1940s. However, once I started to gather the data for them I realized that charts would convey the data much more effectively and efficiently than a GIS map would. I felt that I would just be making maps for the sake of making maps. This once more reinforced for me the need to think critically about how and why you are using a specific digital tool. There is more I would like to accomplish with maps in the context of my project, which I will touch on in my conclusion.

In addition to the continuous map-making, I spent the first part of the semester trying to build a companion website for my digital tools. I had never built a website before, nor did I know the first thing about website design, so I was largely starting from scratch. The goal I had in mind when I started was for the website to host all of the digital projects I created for my dissertation, serve as the basis for my portfolio, and be something that I could easily turn into a personal website that I could use for the job market. I quickly learned that this was too many things.

I spent several weeks experimenting with different website hosting platforms and determining their viability for my project. I ended up choosing Wix based on the variety of tools that were available for free, ease of use, and my overall enjoyment of its design process. Once I settled on the platform, I spent a significant amount of time trying to create a timeline slider that I could use for my maps to easily show change over time. I came away largely dissatisfied with all of the available options and eventually settled on a slideshow presentation format for each of the projects.

With these design details seemingly sorted, I began figuring out how much text to include to accompany the maps, which is where the issues with the concept of a companion website for

my maps became very apparent. The maps require a significant amount of context to understand why they were created and what purpose they served in the larger narrative. The maps themselves have minimal standalone value. This realization coincided with the first presentation I had to give in Capstone, and based on the feedback from that presentation, I decided that a companion website would not be a useful tool for my particular project. I was trying to create a "one size fits all website" that served the purpose of companion, portfolio, and personal website. Without a clear reason for being that specifically focused on one of these components, the website would just be a jumble of ideas more so than anything coherent. The companion aspect also wasn't advancing my research in any meaningful way or adding value to the maps themselves. Because of this I decided to leave the website building to the side and eventually just used it for hosting my digital portfolio for Capstone.

Following my struggles with the website, I decided to focus my attention on the use of digital tools and methods in the classroom. I had done some previous thinking about this, with some successful and unsuccessful attempts in classes I previously taught, so I felt that this would be a useful exercise to help me further develop my own pedagogy. One of the areas I focused on was the value of ESRI StoryMap and StoryMapJS in a classroom setting. I created a "US Intervention in Latin America and the Caribbean" StoryMap that I tried to use in my Modern Latin American History class, but I did not feel that I used it well. I tried to use the lecture to walk students through the map, which I imagine was extremely difficult to follow. Reflecting on this experience and exploring more in StoryMap, I reached the conclusion that if I were to use more StoryMaps that I create, I would treat them as assigned readings that let students explore, or set aside class time for them to do this. Using them as sources for discussion rather than as lecture tools would be a more effective use. But you also have to consider whether the work that

would go into making these is worth it versus just having students read about them in traditional texts.

I also reflected on and started developing an undergraduate "History of Disease" course that would have students use a Story Map to create a narrative of disease spread across time and space. This would have to be an advanced undergraduate course, along the lines of what the World History Center offers through its Digital Atlas Design Internship. The crux of the issue with designing a class with this sort of assignment is how much discussion should be put into the theory of Digital Humanities and how much instruction students should be given about how to make the Story Map. It is hard to find the balance between letting students discover the uses of the tool on their own but presenting enough information that they don't feel that there is too high of a barrier to entry. On the other hand, you don't want to provide the students a step-by-step guide, as they will just be repeating what you tell them to do, which has limited analytical value. I admittedly have not made much progress in figuring out solutions to these issues, and it is probably likely that this course never comes to fruition. But at the very least, it has helped me to think through the challenges that come with incorporating digital tools in the classroom.

The work I was most pleased with throughout my pedagogical work was on creating individual modules based around digital tools. In particular, I created a module for a World Environmental History class session on environmental justice based around the Atlas of Environmental Justice. The EJAlas is a digital platform that shows thousands of different conflicts over the last few decades based around environmental issues. It operates similarly to a gazetteer, providing basic information about these conflicts but also linking to more stories and details if you wish to further explore an individual conflict. I created a class module around the atlas where students explore a conflict of their choosing, discuss it in small groups to learn about

other conflicts, and then have a full class discussion where we cover similarities and differences in conflicts across time and space and identify specific themes and takeaways based on this exploration. For me, this was the most exciting use of a digital tool that I created and I plan to design modules based on other pre-existing spatial history projects that sites such as the Stanford Spatial History Project offer.

Final Thoughts

I would consider my work within the Digital Humanities very much a work in progress. Returning to the idea of the accessory versus argument/interpretive tool, I remain by and large disappointed that so much of my mapping work for my own project has been so much to the accessory side of this coin. I need to do much more work making the existing maps, or future maps, more of a central part of my project. Too often these maps just sit in my dissertation with little explanation or analysis, nor do they (with the exception of the banana trash maps) move my own analysis or thinking forward in any significant ways. However, when I discussed this issue in Capstone recently, I was heartened by Alison's note that I spent my whole life learning how to write but only the last few years learning how to use digital tools.

One of the ways I plan on improving my use of digital tools is to write an article that foregrounds the digital aspects of my project. Writing this article will necessitate that I make my maps and spatial analysis central to the story, rather than accessories to it. This will lead me to better incorporate my text and maps, rather than them being separate parts of the narrative, which they too often are right now. As part of this article, I will likely create additional maps that do more to create a holistic view of Jamaica's agricultural landscape. Right now, my maps are either banana maps or sugar maps, which goes against my own argument about the interconnectedness

of these crop systems. Having these combined within one map, along with potentially other crops, will be more analytically useful. I am not sure what form this article will take yet, but I am excited by the prospects of writing it.

The other area I plan to continue working heavily on is expanding my repertoire of digital tools for use in the classroom. I will continue experimenting with the possibility of creating a StoryMap heavy class while simultaneously developing additional modules to use for specific class sessions. I also plan to explore what other digital tools could be useful within a history classroom. I have come across Plant Humanities projects that explore how to incorporate digital tools and plants into the classroom so that may be one area that I explore further. I believe that becoming the educator and scholar I wish to be means continuing to grow as a Digital Humanist.