Annabel Winterberg

Professor Rael & Dr. Gilbreath

American History through GIS

12 December 2020

"This work will help make you happy": Kate Furbish, Female Scientists and Travel in Maine

Introduction

In 1880 botanist Catherine "Kate" Furbish was traveling towards Eagle Lake at the northern tip of Maine, when she heard a strange account from the driver of her stagecoach. The man described a peddler who used to take their current road, until one day he mysteriously disappeared, with his bones "probably bleaching in the woods somewhere."[1] With that the driver loaded a pistol, in order to protect himself from any threats lurking in the forest. Such a tale might have scared off many a fearful traveller, but Furbish was set on her mission: to catalog and illustrate each of Maine's flowering plants.[2] It was a task she began in 1869, as a sprightly 35 year old and a task that she would not complete until she turned 77 in 1911. It was also a task that took her to every corner of Maine. Furbish and her travels are the subject of this paper, but to understand her, it is important to first understand the contexts in which she existed as a scientist, a traveller and a woman in the late nineteenth century.

First, Furbish existed in a period, in which field sciences like botany were being revolutionized by developments in technology. In studying the evolution of nineteenth century nautical science, scholars Michael S. Reidy and Helen M. Rozwadowski posit that of increasing importance to field scientists were "the spaces inbetween."[3] Transportation technology did more than create a pathway between two centers; it granted access to space that was previously

---

[1] Ada Graham and Frank Graham Jr, *Kate Furbish and the Flora of Maine* (Gardiner, Maine: Tilbury House, 1995), 82.
[2] Graham, 61.
[3] Michael S. Reidy & Helen M. Rozwadowski, "The Spaces In Between: Science, Ocean, Empire," *Isis*, 105, no. 2 (2014): 339.

untouched by scientific endeavors. Historian Jeremy Vetter sees further evidence of the connection between transportation technology and field science in this period. Specifically, he is interested in the symbiotic relationship between railroads and field scientists in the American West. Vetter hypothesizes that as railroads grew in the West, they facilitated more access to sites of scientific interest and thus increased scientific knowledge.[4] His evidence for this hypothesis is that railroads gave subsidies and used scientific discoveries as advertising material.[5] In short, the growth of railroads meant the growth of field science.

Meanwhile, in Maine, we also see the growth of railroads and interest in field science in the latter half of the nineteenth-century. Observing the profitability of railroads during the Civil War, the Maine government passed laws to incentivize cities and towns to invest in train lines.[6] This set off the construction of a number of local, interstate and international railroads in the l870's and beyond.[7] Where railroads grew, they replaced uncomfortable and unpopular modes of transport such as the stagecoach.[8] Simultaneously, amateur botany was growing in popularity as hundreds of people were "taking whatever time they could from the demands of professional and family life, [to make] significant contributions to the natural sciences."[9] Between 1890 and 1895 Maine added over one hundred people to its state list of botanical collectors.[10] However, unlike the American West, there is little evidence of railroad subsidies for science or botanical advertising and there is not yet scholarship on the connections between the two growths.

Kate Furbish engaged in both the travel and the scientific inquiry of the time. Her biographer describes her as "almost continuous[ly] moving about from one place to another

---

[4] Jeremy Vetter, "Field science in the Railroad Era: The Tools of Knowledge Empire in the American West, 1869-1916," *História, Ciências, Saúde-Manguinhos*,15, no. 3 (2008): 598-604.
[5] Vetter: 603, 606-607.
[6] Edward E. Chase, *Maine Railroads: A History of the Development of the Maine Railroad System.* (Portland, Maine: Southworth Press, 1926), 46.
[7] Chase, 46.
[8] John H. White Jr., Wet Britches and Muddy Boots : A History of Travel in Victorian America (Bloomington: Indiana University Press, 2012), 21, 55.
[9] Graham, 63.
[10] Graham, 120.

during most of her maturity."[11] She was also a successful scientist, with expertise in botany that rivaled many of the acclaimed figures of her field.[12] In fact, Graham attributes much of the growth in Maine botany in the 1890's to public interest in Furbish's work.[13] Yet, Furbish was not approaching these two arenas unobjectionably: her experiences and successes as a scientist and a traveler were colored by a gendered lens.

As field science grew in the nineteenth century, so did the complicated role of women within it. Studying the British botanist Marianne North, Narin Hassan notes that there were different expectations for scientific men and women.[14] North failed to win the acclaim afforded to much less successful men because her contributions were overlooked.[15] Barbara Gates sees this trend throughout the British scientific community, writing that "women were kept just out of reach of scientific cultural preserves, and the means of their exclusion were many."[16] Specifically, female scientists were seen as charming hobbyists instead of professionals.[17] Still, Gates asserts that female naturalists were able to find ways to disrupt the masculine discourse surrounding their field in order to be taken seriously.[18]

Historical scholarship supports similar conclusions for the nineteenth century United States. Scholar Tina Gianquitto notes a contrast between the "feminine" realm of the home and the "masculine" realm of science.[19] There was fierce debate surrounding American women who chose to engage in science, but ultimately "As science became increasingly professionalized and threatened to push amateurs entirely out of its sphere these women, and others carved out a place

---

[11] Graham, xii.
[12] Graham, 75.
[13] Graham, 120.
[14] Narin Hassan. ""A Perfect World of Wonders": Marianne North and the Pleasures and Pursuits of Botany," in *Strange Science: Investigating the Limits of Knowledge in the Victorian Age*, edited by Lara Karpenko Lara and Shalyn Clagget (Ann Arbor: University of Michigan Press, 2017), 65.
[15] Hassan, 63-65.
[16] Barbara T. Gates, *Kindred Nature: Victorian and Edwardian Women Embrace the Living World* (Chicago: University of Chicago, 1998), 66.
[17] Gates, 67.
[18] Gates, 7.
[19] Tina Gianquitto, *Good Observers of Nature : American Women and the Scientific Study of the Natural World, 1820-1885*. (Athens: University of Georgia Press, 2007), 3.

in an increasingly hostile environment."[20] Women found ways to engage in the masculine world of science on their own terms.

This same pattern applies to Kate Furbish. She went into the scientific field against all odds, as a middle class woman whose only career options were teaching or nursing.[21] At the start of her career, Furbish struggled with her position with the botanical world and worried about her male colleagues not taking her seriously.[22] Yet, after considerable time and effort she was able to prove herself to the scientific community. In a letter to a colleague she advised, "Work into your science as far as you can. Do everything which is modest to call the attention of the public to your knowledge… this work will help make you happy."[23] It's clear that Furbish, like other female scientists of her day, was able to find confidence and success while engaging in a traditionally masculine realm.

Like with science, women had a complicated relationship to travel. Historian John H. White believes that "Travel in early America was largely a male enterprise."[24] His evidence for this comes from illustrative examples. For instance, he describes an 1887 report where a woman gave birth in a packed train car with only three other women aboard to help her.[25] Amy G. Richter partially pushes back against this in her book, *Home on the Rails,* where she argues that "There was nothing implicitly subversive in a woman's decision to travel" and in fact engaging with travel technology was a mark of the "modern woman."[26] However, she does admit that railroads were seen as places of "masculine power" in contrast to the femininity of the home.[27] Thus, women were only supposed to engage in train travel in ways that "clung to the conventions

---

[20] Gianquitto
[21] Graham, 49.
[22] Graham, 71.
[23] Graham, 72.
[24] White, xx.
[25] White, 442.
[26] Amy G. Richter, *Home on the Rails: Women, the Railroad and the Rise of Public Domesticity* (Chapel Hill: The University of North Carolina, 2005), 9, 35.
[27] Richter, 1.

of 'respectable womanhood.'"[28] For instance, women could fulfill feminine roles by using travel to go on a honeymoon or visit their families.[29] There were also a number of conventions women were supposed to follow on trains, such as travelling with a male companion and not speaking to strangers.[30] Finally women's trips were expected to be "finite," a brief interlude from domestic life.[31] Overall, women were expected to engage in the masculine world of transportation in a feminine way, or not travel at all.

These expectations for female travelers are in sharp contrast to the way that Kate Furbish travelled. First, rather than travelling for feminine ends, Furbish travelled for science, a traditionally masculine realm. Second, she almost always journeyed alone, often in extreme and dangerous locations.[32] Finally, her trips were anything but finite as she was perpetually moving around. It is clear that Kate Furbish was not engaging in travel in the same way as the other women of her day. Yet, a great deal that remains a mystery about the way in which Kate Furbish travelled. We know the places that she travelled to, when she travelled to them and how she got from individual townships to the woodland locations in which she found specimens. Yet how she travelled between the various townships and cities of Maine remains mostly unknown.

This context around Kate Furbish does much to illuminate her figure, but it also brings up several questions about the interconnected nature of science, travel and women. First, does the symbiotic relationship between the railroads and field science that Vetter observed in the American West exist in other parts of the country? Namely, does the growth of railroads correlate with the growth of field science in Maine? Secondly, does the same relationship that existed between women and field science, exist between women and train travel? We know that women scientists resisted the gendered presumptions surrounding their work and engaged with

---

[28] Richter, 32.
[29] Richter, 35.
[30] Richter, 45.
[31] Richter, 37.
[32] Melissa Cullina, "Kate Furbish: Maine's remarkable botanical artist, botanist and plant collector," in *The Botanical Artist,* 23, no. 2 (2017): 32.

science on masculine terms. But did they engage with the modes of scientific knowledge gathering, in this case travel, in the same way? Did women scientists challenge the expectations placed on travelling women? If so, what modes of travel did they engage in?

These are the questions that I hope to answer in this paper and as a travelling female scientist, Kate Furbish is the perfect figure with which to find answers. The following sections will explore how Kate Furbish was able to travel around Maine. I hypothesize that she followed the tradition of female scientists challenging male-dominated spaces and primarily used train travel to navigate the state. Since Furbish pushed back against expectations in the scientific field, it follows that she would push back against travel expectations and use developing technology to further her scientific pursuits.. I also believe that by using Maine railroads to discover new specimens, Furbish's scientific growth correlates with railroad growth and thus validates Vetter's hypothesis.

Initial Findings

The method that I have chosen to analyze Furbish's travels is Geographic Information Systems or GIS. GIS gives me the unique capability to get a full picture of all of Furbish's travels and perform visual and statistical analysis. The data I used came from a spreadsheet from Bowdoin College's Special Collections and Archives, which contained information about each species of plant that Furbish cataloged. I was able to extract data where she collected her specimens and the years that she did so, revealing that Furbish visited 167 locations between 1869 and 1911. I could then export this data into the GIS application ArcMap in order to plot all of the locations Furbish visited.

Looking at Figure 1, one can see that many of the locations that Furbish travelled to were close to her home in Brunswick and along the heavily populated coast of southern Maine. However, it's also clear that Furbish went to a great many locations in central, western, eastern

and northern Maine. Overall, Furbish seems to have travelled to much of the state in the six decades when she was active.

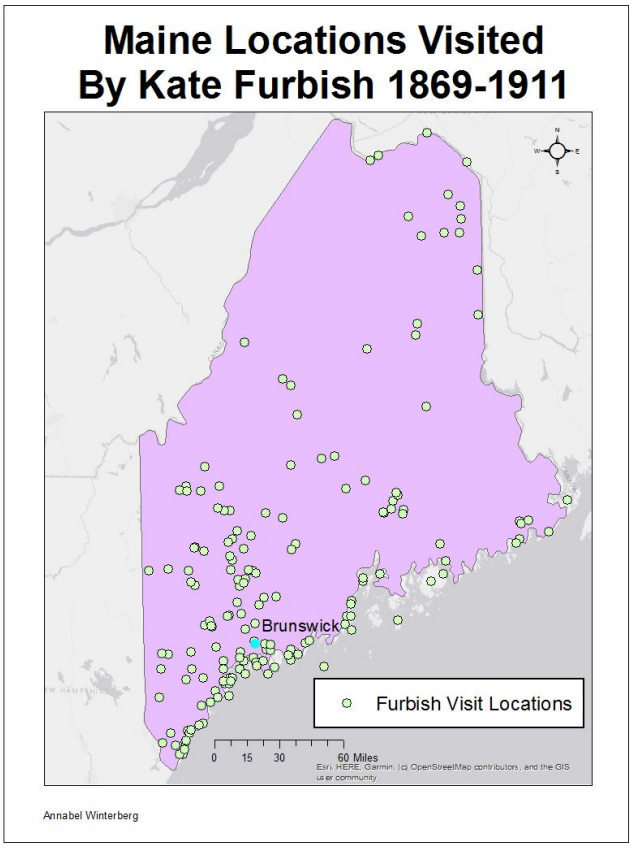

Figure 1: Locations in Maine Kate Furbish Visited 1869-1911.

However, this map gives no information about the Maine railroad lines that Furbish might have travelled on, or the extent of the townships that she was travelling to. To get that information, I georectified six maps of Maine railroads between 1878 and 1915. Because the maps were historical, I was not able to map the change in railroads in equal intervals. The shortest number of years between maps is six, the longest is twelve. Still, the maps were frequent enough to give me an idea of how the railroads were growing within a certain period of time. Next, I seperated Furbish's data into increments that matched the span of time between each railroad map. Finally, I joined Furbish's location data to a map of Maine townships, so that I could map the full extent of the area she was visiting and how close it might have been to a railroad. This had the unfortunate effect of losing some location data, as some places Kate

Furbish visited were landmarks, e.g. Mount Katahdin, instead of townships. She also sometimes visited multiple locations within a township. However, ultimately only a small percentage of locations were conflated and in some maps I could overlay location data with township data. Combining all of this data, I could visualize how Furbish's visits over time matched with the growth of railroads.

Travel and Railroad Growth over Time

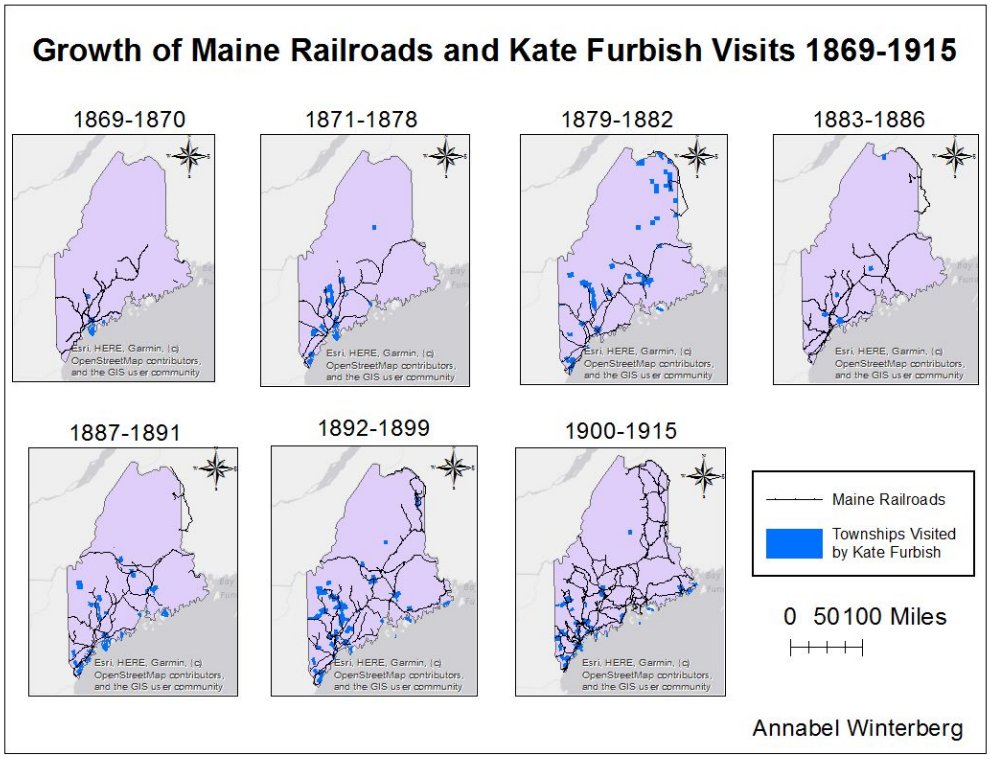

Figure 2: Growth of townships visited by Furbish and Maine railroads between 1869 and 1911

Looking at Figure 2 it is clear that both railroads and Furbish's visits to various townships were growing over the late nineteenth century. There appears to be some connection between the two growths, with many railroad lines running through visited townships. However this is not enough to determine if railroad growth correlates to Furbish's visits. To test this I conducted some statistical analysis and tabulated the change in two measures over time. The first was the percent of the townships that Furbish visited in a given period that intersected with a railroad. I defined insterect as lying within two miles of the township on the map.The second

calculated measure was the average distance the townships in a given period were from a railroad.

Year	Percent of Townships that Intersect Railroads	Average Distance to a Railroad
1869-1878	64%	5.69 miles
1879-1882	60.52%	4.21 miles
1883-1886	55.56%	3.66 miles
1887-1891	62.86%	2.65 miles
1892-1899	73%	1.81 miles
1900-1911	78.43%	1.82 miles

Table 1: Percentage of Furbish townships that intersect with railroads and average distance to a railroad over time

Table 1 shows the results of these calculations. Throughout the 42 year period that Furbish travelled, her rate of township-railroad intersection was always over 50 percent. These percentages are significant considering that only 18.36% of townships were connected to a railroad at the peak of Maine's railroad infrastructure in 1915. Thus, Furbish's visited townships intersected railroads at rates two to four times higher than if she was visiting them at random. A similar pattern occurs with average distances to a railroad, which are always less than 6 miles from a railroad, compared to the 7.08 miles away for an average township in 1915. At certain time periods these distances were nearly four times lower than the distance of an average township to a railroad Overall, these patterns suggest that Furbish's visits were correlated with the locations of railroads.

Another trend revealed by this table is how these percentages and distances increased or decreased over time. The percent of townships intersected by railroads in 1911 was 14.83% higher than the percent intersected by railroads in 1869. Similarly, the distance to a railroad was 3.87 miles shorter in 1911 than it was in 1869. We see a steady decrease in distances and

increase in percentages over time, with one notable exception. Between 1879 and 1882 the percentage of intersected townships falls 3.48% before falling another 5.32% between 1883 and 1886. The percentage rebounds upward by 1891, but these two time periods are still anomalous occurrences in a general pattern of correlation.

Seeing this, my next step was to make sure that this correlation was not the result of a misinterpretation. Perhaps Furbish was repeatedly visiting areas over time that started out without railroads and later gained them. This would make it look as if she was starting to use railroads over time, when in fact the growth of rail lines had little to do with her travels. To test if this is the case I mapped and performed statistical analysis on only the new locations that Furbish visited over time. If Furbish was using the railroads to access her destinations, then the new destinations she visited were likely to be along newly created railroads. Once again, newly visited locations and railroads seem to be connected visually. Figure 3 shows many new locations that overlap exactly with rail lines and many more close by.

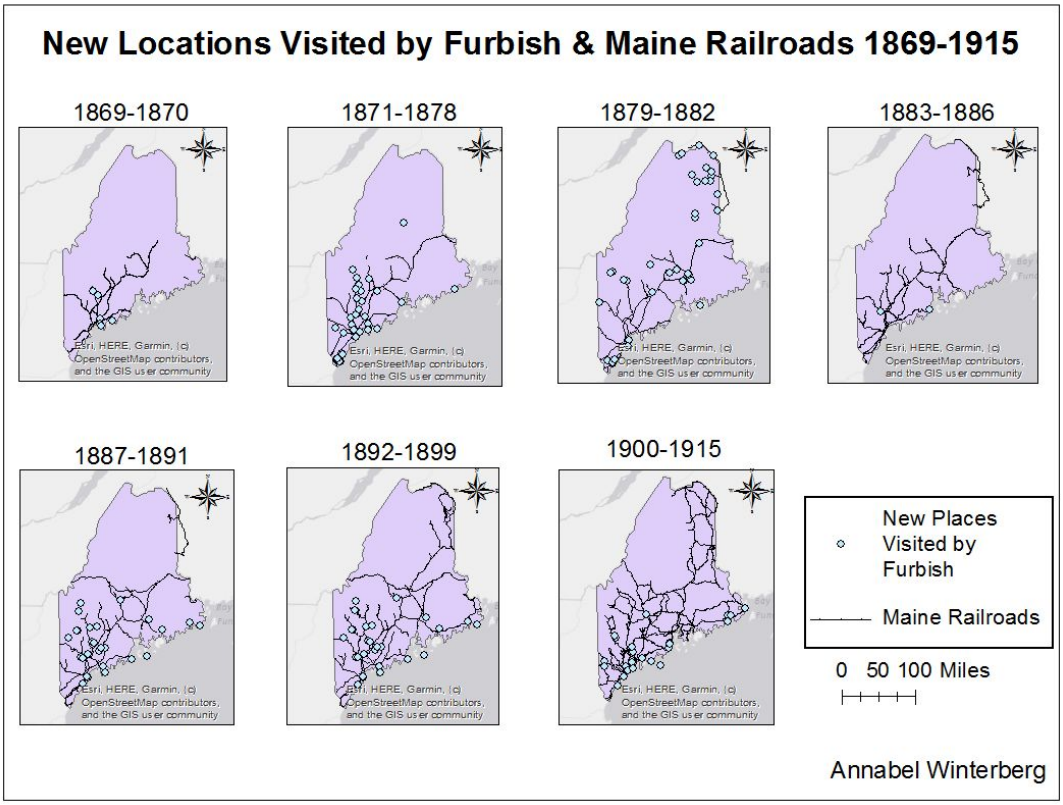

Figure 3: Growth of new locations visited by Furbish and Maine railroads between 1869 and 1911

Year	Percent of New Townships that Intersect Railroads	Average Distance to a Railroad from a New Township
1869-1878	64%	5.69 miles
1879-1882	58.33%	4.41 miles
1883-1886	100%	0 miles
1887-1891	60.87%	4.71 miles
1892-1899	72%	2.71 miles
1900-1911	82.61%	1.74 miles

Table 2: Percent of new Furbish townships that intersect with railroads and average distance to a railroad over time

Table 2 shows the results of the same calculations for Table 1, only with newly visited townships instead of all visited townships. Overall, the correlations that can be seen in Table 1 are still present here. Once again, throughout all time periods over half of all the new townships that Furbish visited intersected a railroad. In fact, the highest percentage of intersecting townships is actually 4.18% more than the highest percentage from Table 1. Similarly, the average distance to a railroad continues to always be under 6 miles, and the lowest average distance is .07 miles closer to a railroad than the lowest distance from Table 1. These higher percentages and lower distances actually suggest a slightly higher correlation between railroad growth and Furbish's visits.

However, the same anomalies that existed in Table 1 continue here and there are a few more inconsistencies that require explanation. Once again we see a relative increase in percentages over time and a decrease in distances over time. We also see a drop in percentages between 1879 and 1882, which is actually more extreme than the drop in Table 1. From there the percentage rises to 100%, before assuming its regular pattern in 1891. Furthermore, unlike Table 1, we do not see a steady drop in average distances over time. Between 1879 and 1882 the figure

drops to 0 miles and then shoots back up to 4.71 miles for 1891 before dropping again. This suggests that something different was happening with Furbish's travels between 1879 and 1891. Still, even these periods show a correlation between railroad growth and Furbish's new visits.

My next step was to try and make sense of these trends and inconsistencies that emerged in the tabular data. I wanted to study why there was a growing correlation between Furbish's journeys and railroads over time instead of a steady or declining correlation. I also wanted to explore why the correlation appeared less strong between 1879 and 1882 and then either weaker or exceptionally strong between 1882 and 1886. Finally, I wanted to know why things had reverted to a stable pattern by 1891. Were these observations a result of fluctuations in train usage, or were there other biographical factors that could explain them? To answer this question I closely analyzed the maps of Furbish's travels between 1869 and 1911, while relying on biographical and contextual information to see if I could explain her travel behavior.

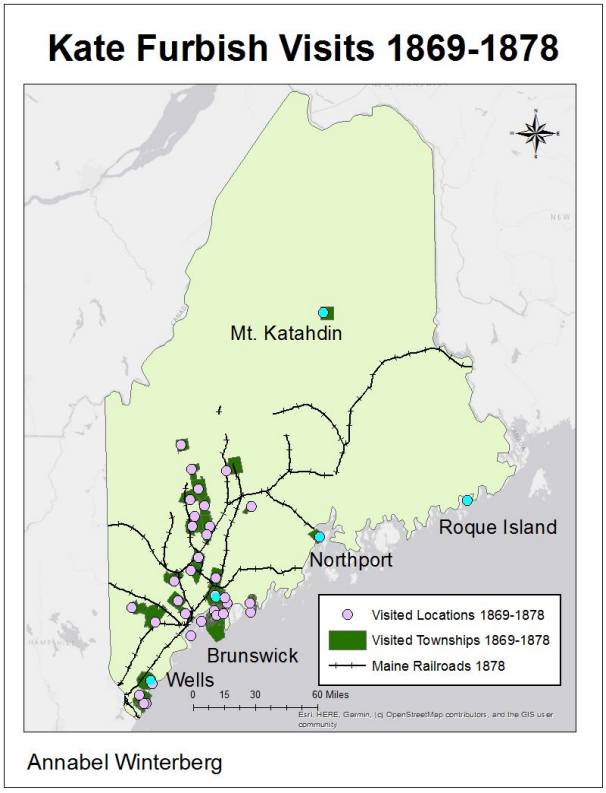

Figure 4: Where Kate Furbish visited between 1869-1878 and Maine railroads in 1878.

Figure 2 shows Furbish's travel patterns in the early years of her botanical collecting. First, it is important to note that Furbish started travelling as Maine underwent one of its largest railroad booms.[33] Perhaps the easier access to more of Maine helped push Furbish to begin travelling. In any case, Furbish began cataloging flora in 1869 in the areas around her Brunswick home, reflected on the map in the cluster of dots around Brunswick.[34] Another cluster on the map is centered around Wells, a place where Furbish had family.[35] Many of these locations were ideal for a budding botanist, both because of their familiarity and their proximity to railroads.

However, by 1875 Furbish began collecting in earnest and started to venture to places far from home.[36] She began to remain for weeks or months at remote locations, boarding with local farmers, who could direct her to the locations of rare plants.[37] Some of these places had no railroad access, such as Mt. Katahdin in the north or Roque Island along the coast. Furbish likely had to travel to these places by stagecoach. Nevertheless, there are also some distant locations on this map that Furbish was likely reaching by train. One example is Northport, which lay at the end of a new rail line. The proximity of Northport to a railroad and the fact that Furbish visited nothing else around it suggests that Furbish made use of the train to visit a newly accessible location. Thus, this early map, in conjunction with Table 1, suggests that as a new scientist Furbish made use of the railroads to journey close to home and farther away, while also starting to venture to areas without rail access.

[33] Chase, 46,70. 73, 77, 82, 100.
[34] Graham, 66.
[35] Graham, 13.
[36] Graham, 61, 66.
[37] Graham, 68.

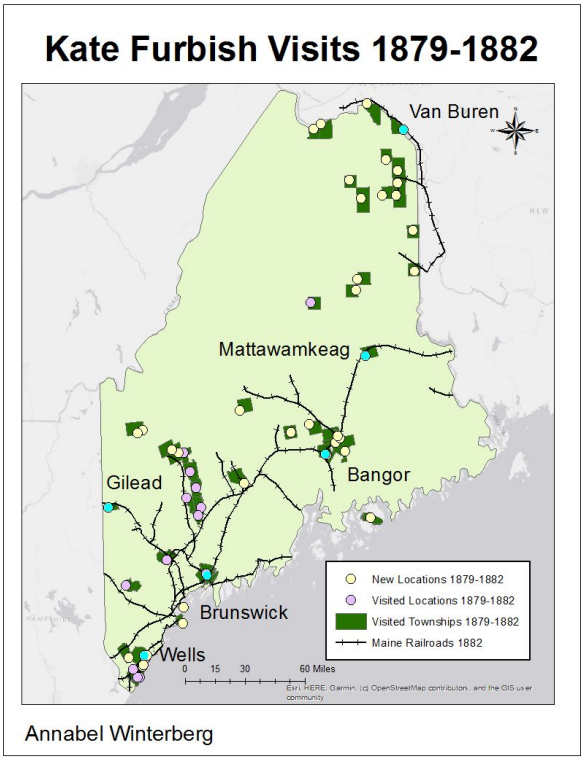

Figure 5: Where Kate Furbish visited between 1879-1882 and Maine railroads in 1882.

Next, there is the period between 1879 and 1882, as shown in Figure 5. In Tables 1 and 2 this period was notable for a decline in the percentage of railroad-adjacent townships that Furbish visited. Though Furbish kept collecting in familiar areas such as Wells during this time, she largely stopped her cataloging efforts around the vicinity of Brunswick. Instead, sht travelled to a plethora of new locations. For instance, there is a cluster of new locations around Bangor, a growing railroad hub.[38] It also appears likely that Furbish used the railroads to visit the western town of Gilead. Overall, there is certainly evidence that Furbish was using the rails to get to new and familiar locations during this time.

However, this was also the period in which Furish made her two most strenuous and remote trips. She spent summers of 1880 and 1881 botanizing in the secluded towns of northern Aroostook county. We know that Furbish partially rode the train on this journey north, up to Mattawamkeag, before taking a stagecoach the rest of the way.[39] Figure 4 also reveals that some

[38] Chase, 73.
[39] Graham, 77.

northern towns such as Van Buren were newly connected to a Canadian railroad. However, most of the places that Furbish visited in Aroostook were very remote and only accessible by mail stagecoaches.[40] These northern trips likely explain the declining correlation between railroads and visits between 1879 and 1882. Furbish was indeed moving away from the railroads, albeit not completely.

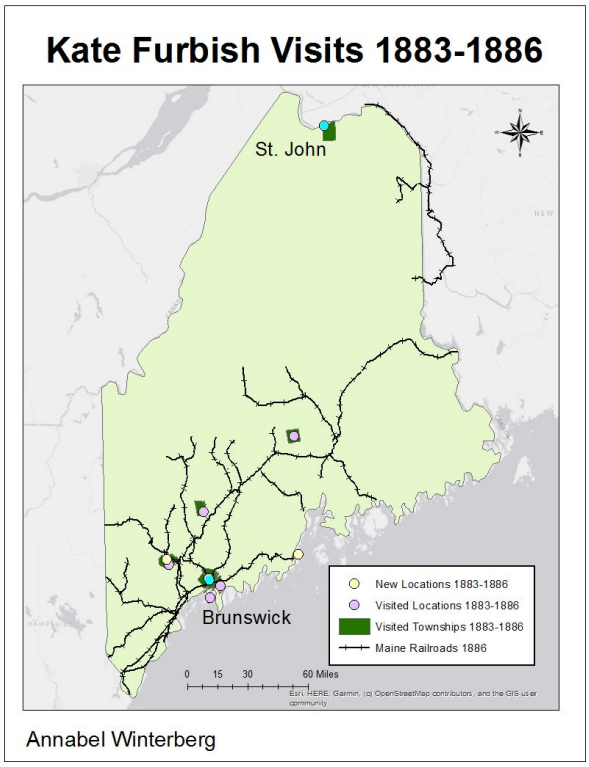

Figure 6: Where Kate Furbish visited between 1883-1886 and Maine railroads in 1886.

The next period mapped was between 1883 and 1886, which is shown in Figure 6. This was the most anomalous period in the tabular data, with either the lowest or highest values. However, looking at the map the reasons for these discrepancies become clear. The data was skewed because Furish rarely travelled during these years. Figure 6 only has 10 locations and only two of these are new locations, meaning the dataset for these years was very small. The percentages were likely greatly affected by the fact that one of these ten visits was to St. John,

[40] Louise H. Coburn, *Kate Furbish, Botanist: An Appreciation,* (1924), 2.

which is very far from any railroad. Similarly, both new townships visited fell along a railroad, which made those statistics unnaturally high.

The reasons for Furbish's lack of travel during this period are partially known and partially mysterious. She stopped taking trips for most of 1883 and 1884 because she was on a Grand Tour in Europe.[41] She returned to Maine in 1884, but halted her botanical activities and communication with others. Her biographer Ada Graham hypothesizes that Furbish may have been suffering from mental illness or a physical ailment during this time.[42] Furbish often complained of poor health which was made worse by the strenuous travel conditions she endured.[43] For instance, describing one of her stagecoach trips Furbish wrote, "[I] Rode and traveled in woods (time gone 7 hours) in the hot sun.. and when I got back my blood boiled, almost, I trembled and felt half dead."[44] The toll that arduous modes of travel took on Furbish's body and mind may have changed her travel patterns from this period on.

It is worth noting that nearly all of the places Furbish visited during this period were along railroad lines. The only exception to this trend was the aforementioned town of St. John, which Furbish likely visited as an extension of one of her Aroostook trips before she went to Europe. This suggests that during her time of withdrawal, Furbish favored travel destinations with access to railroads.

[41] Graham, 91.
[42] Graham, 98-99.
[43] Graham, 99.
[44] Graham, 75.

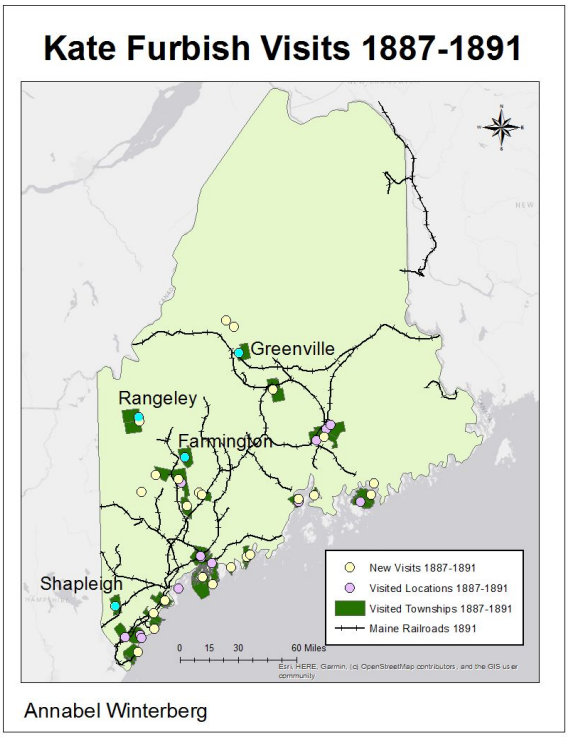

Figure 7: Where Kate Furbish visited between 1887-1891 and Maine railroads in 1891.

Figure 7 shows 1887-1891, the next period I looked at. Furbish was still relatively silent in these years, but the map shows that she had restarted her travels around Maine. During this period, Furbish mostly stuck to the coast of southern Maine and towns like Farmington in the center-west. She avoided the north, which was still rather inaccessible for railroad travel. There were still some towns she visited, such as Rangeley, that were far from railroads and likely required stagecoach travel. However, there is more proximal evidence that Furbish was using the railroads to botanize in towns like Greenville and Shapleigh. Overall, this map supports the idea that Furbish was relying more on the railroad during this period. This could be because she had changed her travel patterns in the wake of her illness, because the new railroad routes opened up new areas for exploration, or a combination of both factors.

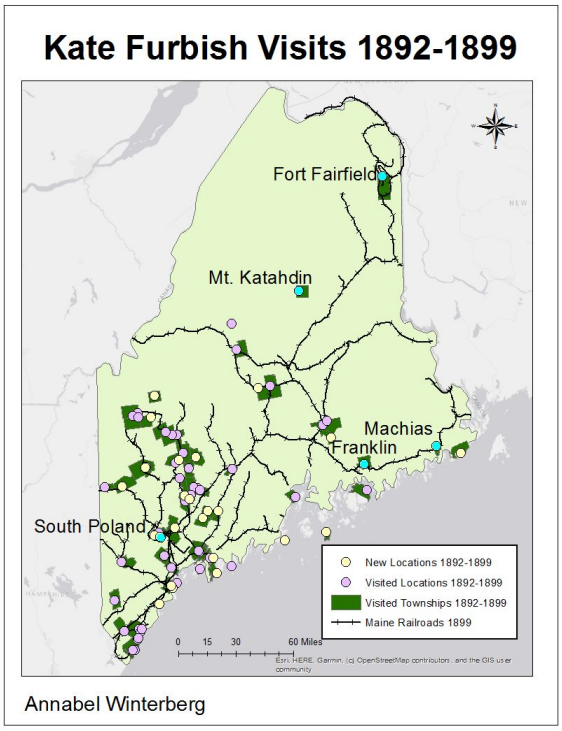

Figure 8: Where Kate Furbish visited between 1892-1899 and Maine railroads in 1899.

The period between 1892 and 1899 was another in which the tabular data shows a rising correlation between visits and railroads. Indeed, this trend appears clearly on Figure 8, which shows that Furbish visited a flurry of places in Maine during this period, most of them along railroads. From 1893 to 1895 Furbish worked as a live-in botanist at the Poland Spring House in South Poland.[45] This gave her a new base of operations from which to botanize and many of the sites she visited in this period are along railroads in South Poland's vicinity. Furbish also seemed to capitalize on the growth of new northern and eastern railroads.[46] She took her first one-stop trip to Aroostook county, collecting plants in Fort Fairfield, which was newly connected to a Maine railroad. She also visited multiple new locations, such as Machias and Franklin, along Washington county's neweastern railroad. In fact, the only location which seems to be considerably far from a railroad is Mt. Katahdin, which Furbish had already visited several times

[45] Graham, 111.
[46] Chase, 95, 98.

before. This map suggests that Furbish had become very reliant on railroads for transportation, at the expense of locations that could only be reached by stagecoach.

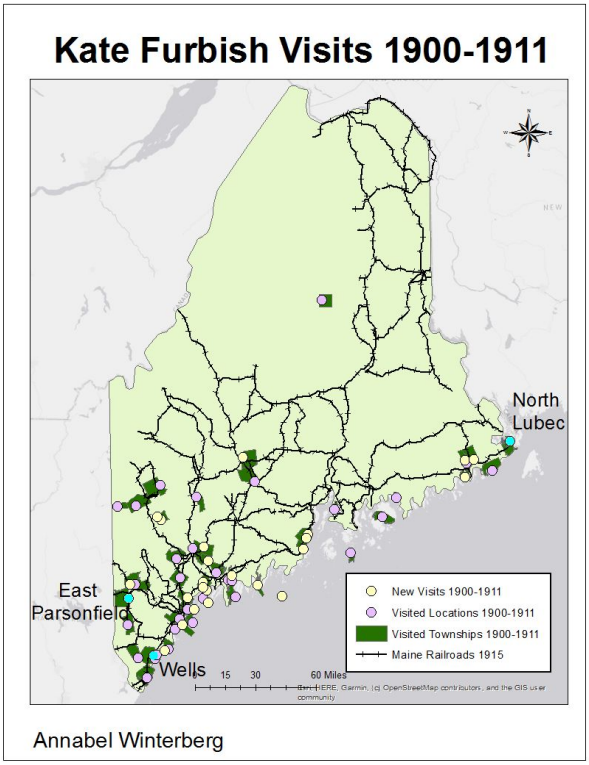

Figure 9: Where Kate Furbish visited between 1892-1899 and Maine railroads in 1899.

Figure 9 is a map of visits 1900-1911, the final years in which Furbish was active. And the botanist was very active in this period, displaying a single-minded devotion towards her collecting mission. This was in spite of the fact that she was now an elderly woman who had entered her 70's in 1904.[47] Furbish's physical ailments had also become worse over time. Her hands and feet were hurt by neuralgia and she suffered from "dropsical limbs" which could sometimes render her immobile for weeks at a time.[48] These conditions may have been one reason that Furbish's correlation with railroad usage was the highest during this period. Her ailments made her work painful enough without the added hurt of arduous travel. Indeed, there are very few locations on Figure 9 that could only be reached by stagecoach. Maine's railroad infrastructure was also at its peak during this period, which granted Furbish an unprecedented

[47] Graham, 123.
[48] Graham, 123.

amount of access to the wilderness via train. Once again it seems likely that Furbish used railroad growth to visit new locations such as East Parsonsfield and North Lubec. A final factor that could explain this exceptionally high correlation was that Furbish relocated to Wells around 1900 and began to focus her botanizing on the southern Maine coast.[49] One of the benefits to this geographical area was that the southern coast had the densest network of rail lines in Maine. Indeed, Ada Graham reports that one of the reasons that Furbish lived in Wells was that her cousin could pick her up from the train station.[50] Overall, it seems highly probable that Furbish was using the railroad as her main form of transport during this time.

Moreover, these biographical maps taken in conjunction with the tabular data suggests that Furbish was indeed using the railroads to travel to her botanical sites throughout her life. Her reliance on train travel likely increased over time due to a combination of increased rail access and the difficulties of sickness and age. This insight suggests that railroads did more than connect scientists to sites of knowledge, they also let them overcome some of the limitations of the human body so that they could engage in the field.

Yet, this also shows that Furbish was not using the railroad at all times. Furbish undertook her most sustained travels in Aroostook, the most unexplored and part of Maine, without the aid of railroads.[51] By the early 20th century northern Maine would become more accessible by rail, but Furbish would never visit it as frequently and thoroughly as she did in the early 1880's. Furthermore, even at the height of her railroad travel, there were still places that Furbish went that were a considerable distance from the train. This suggests that although Furbish did utilize train technology, she was never completely dependent on this mode of transportation.

---

[49] Graham, 129.
[50] Graham, 29.
[51] Graham, 75.

Frequency of Visits

GIS has shown the connections between railroads and visits over time, but the next area of exploration is the frequency of Furbish's visits. We know Furbish likely used the railroads to visit more or new locations, but did the railroads allow her to visit some locations more often than others? Figure 10 illustrates how frequently the botanist visited each township. It seems that she went particularly often to townships surrounding her hometown of Brunswick, along the southern tip of Maine and along a line in west-central Maine. All three of these areas look to be commonly intersected by railroads.

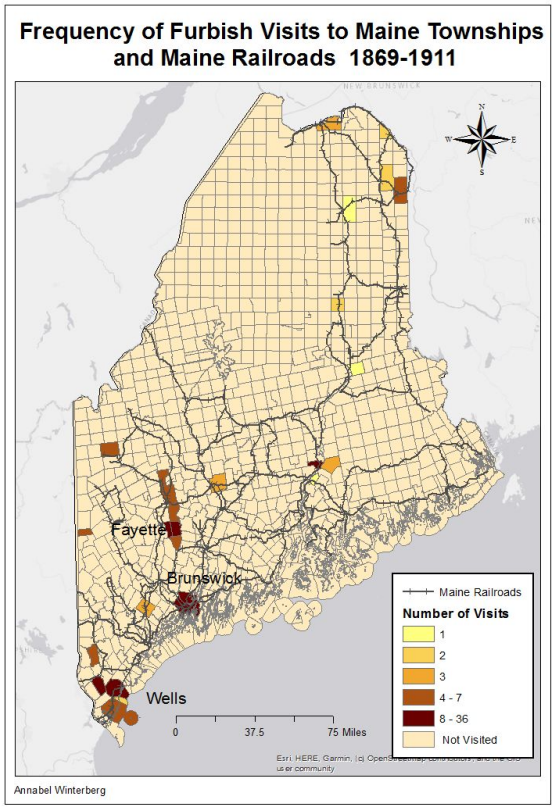

Figure 10: Frequency of visits by Kate Furbish to the Maine Townships and Maine Railroads in 1915

Number of Visits	Percent of Townships that Intersect Railroads	Mean Distance to a Railroad
1	17.71%	4.95 miles
2	26.87%	6.20 miles
3	14.76%	5.46 miles

4-7	39.1%	3.62 miles
8-36	31.18%	3.24 miles

Table 3: Average Distance to a Railroad for the New Townships visited by Furbish over time

Table 5 shows the results of the statistical analysis done with this data. Once again I calculated the percentage of townships that intersected railroads and the mean distance to a railroad. These calculations specifically looked at change over number of visits. This data is more inconclusive than the previous tabular findings. First, only 17.71% of the townships that Furbish visited once were within two miles of a railroad. 17.36% percent of counties that Furbish did not visit were connected to a railroad, a very similar figure. This suggests that there is not much of a correlation between places that Furbish visited once and railroads. However, the mean distance to a railroad is 4.94 miles for places Furbish visited once, compared to 7.17 miles for places that Furbish did not visit. So perhaps a small correlation does exist.

The percentage of intersecting townships does go up over time, but it does not go up evenly. In fact, the places Furbish visited three times are actually less likely to be connected to a railroad than a typical township in Maine. Perhaps these places happened to be both out of the way and rich in flora so they required multiple trips. However, any place that Furbish visited more than four times had a percentage of intersecting townships that was over 30%. This is about double the percentage of townships she did not visit, suggesting a possible correlation with her most frequent points of visitation and access to railroads. However, these percentages are considerably lower than those seen with the change over time statistics.

A similar pattern can be noted with change in average distance to a railroad. The calculations suggest that the more times that Furbish visited a place, the more likely it was to be closer to a railroad. Once again, however, the final distances seen here are at least a mile more than the distances over time. Thus, the potential correlation between visits over time is not as

strong for the frequency of visits. Kate Furbish may have used the railroads to travel certain places more often, but it is harder to say.

George L. Goodale: A Point of Comparison

Of course, Kate Furbish was just one person, which makes her travel patterns hard to generalize. To this end, I sought to find another figure whom I could compare Furbish to. In the end, I picked a man named George L. Goodale, who was an ideal choice for several reasons.[52] First, like Furbish he was a Maine botanist who travelled the state to catalog flowering plants. Second, unlike many other botanists of Furbish's day, there is a good amount of data about his travels. The Consortium of Northern Herbaria has some location data for Goodales' flora samples and the botanist also published a catalogue detailing where he found many of his plants.[53] Combining these data sources into a spreadsheet revealed 53 distinct locations that could be analyzed through GIS. Goodale was also operating earlier than Furbish, in the 1850's and 1860's. This contrast allows me to explore how Furbish's travel patterns differed from those of a man operating in an era of less railroad access. Finally, Furbish frequently compared herself to Goodale, specifically his catalog, which she referred to as "incomplete".[54]

However, there were also some limitations to George Goodale's data. Most notably, Goodale rarely recorded the dates that he visited various townships. This means that I was unable to perform analysis on the growth or frequency of Goodale's visits as I did with Furbish. Goodale's data is also much more incomplete than Furbish's and there are a great many plants he collected that do not include location data. This means that Goodale could have travelled more widely than what is shown on the following maps. However, I was still able to do a great deal of analysis with the available Goodale data and draw a number of interesting conclusions.

---

[52] I am also admittedly partial to Goodale because we share a hometown of Saco, Maine.
[53] George L. Goodale, *A catalogue of the flowering plants of Maine* (Portland: Printed by David Tucker, 1862).
[54] Graham, 73.

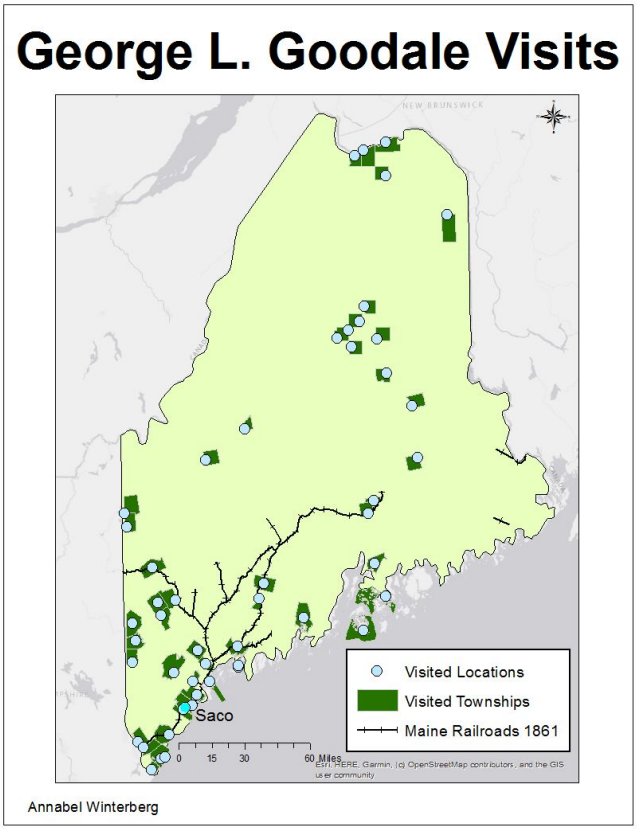

Figure 11: Locations of George Goodale visits and Maine Railroads in 1861

Figure 11 maps the places that Goodale visited and the Maine railroads in 1861, a year before Goodale published his catalog. The map reveals that, like Furbish, Goodale travelled to nearly every corner of Maine to collect scientific specimens. Specifically, he seemed to favor southern Maine locations near his home of Saco, western Maine and the northern wilds of Aroostook county. However, unlike Furbish, Goodale was travelling in a period before Maine's railroad infrastructure expanded to most of the state. Some of his locations do overlap with railroads in southern Maine, but overall the visual connections between railroads and scientific visits seem less striking than with Furbish.

Townships	Percent of Townships that Intersect a Railroad	Average Distance to a Railroad
Townships Goodale Visited	37.5%	29.93 miles
All Maine Townships	7.31%	24.24 miles

Table 4: Percent of Goodale townships and all townships that intersect with railroads and mean distance to a railroad

Table 4 furthers these findings. Like with the Furbish data, I calculated the percent of visited townships within two miles of a railroad and the average distance of a visited township to a railroad. The table reveals that Goodale visited townships with railroads at five times the rate than he would have at random. However, he also visited them at a rate 18.1 to 40.9% lower than Furbish. Furthermore, the townships he was visiting were on average 5.69 miles farther from a railroad than an average township in Maine. They were also 24.24 miles farther than even the farthest of Furbish's average distances. This suggests that many of the places Goodale visited were very far from railroads. Overall, the tabular and visual data do provide some evidence for a correlation between railroads and Goodale's visits, but it is inconsistent and far weaker than Furbish's correlation.

So if Goodale was not taking the train, how was he journeying through Maine? Furbish's biographer provides a clue when she describes Goodale as travelling "mainly by canoe."[55] This piece of information made me wonder if Goodale was navigating Maine through its rivers and lakes. I thus decided to analyze Goodale's travel data in conjunction with a map of Maine's waterways in order to determine if there was a correlation between the two. I conducted the same analysis on the locations Furbish visited to see how her river travel patterns diverged or connected with Goodale's. Unfortunately, due to limits of GIS, I was unable to determine the average distance to rivers and lakes combined, but that information likely would not have greatly affected the results.

Townships	Percent of Townships that Intersect Rivers or Lakes	Average Distance to a River
Townships Goodale Visited	68.75%	4.26 miles
Townships Furbish Visited	53.85%	6.95 miles
All Maine Townships	15.68%	20.57 miles

Table 5: Statistical analysis of Goodale, Furbish and Maine townships and Maine rivers and lakes

[55] Graham, 77.

Table 5 reveals that the townships Goodale visited were much more likely to be connected to a river than to a railroad. His percentage of intersecting townships nearly doubles from Table 4 to Table 5 and his average distance falls 25.67 miles. These numbers are even more significant considering only 15.68% of Maine townships are connected to a major waterway and the average distance to one is 20.57 miles. Overall, it seems as if there is much stronger correlation between Goodale and water travel then there is for Goodale and train travel.

There also looks to be a connection between Furbish and waterway use. Her percentage of townships within two miles of a river or lake is 3.43 times greater and her average distance is 13.62 miles shorter than that of an average Maine township. Still, the percentages are higher and the average distances are lower in this table than they are for any of the values in Table 1. This indicates that Furbish's correlation to railroad travel is stronger than her correlation to water travel. Still, her connection here is not insignificant. To try and determine these connections more firmly I examined a map of Furbish's and Goodale's travels mapped against Maine's waterways and railroads.

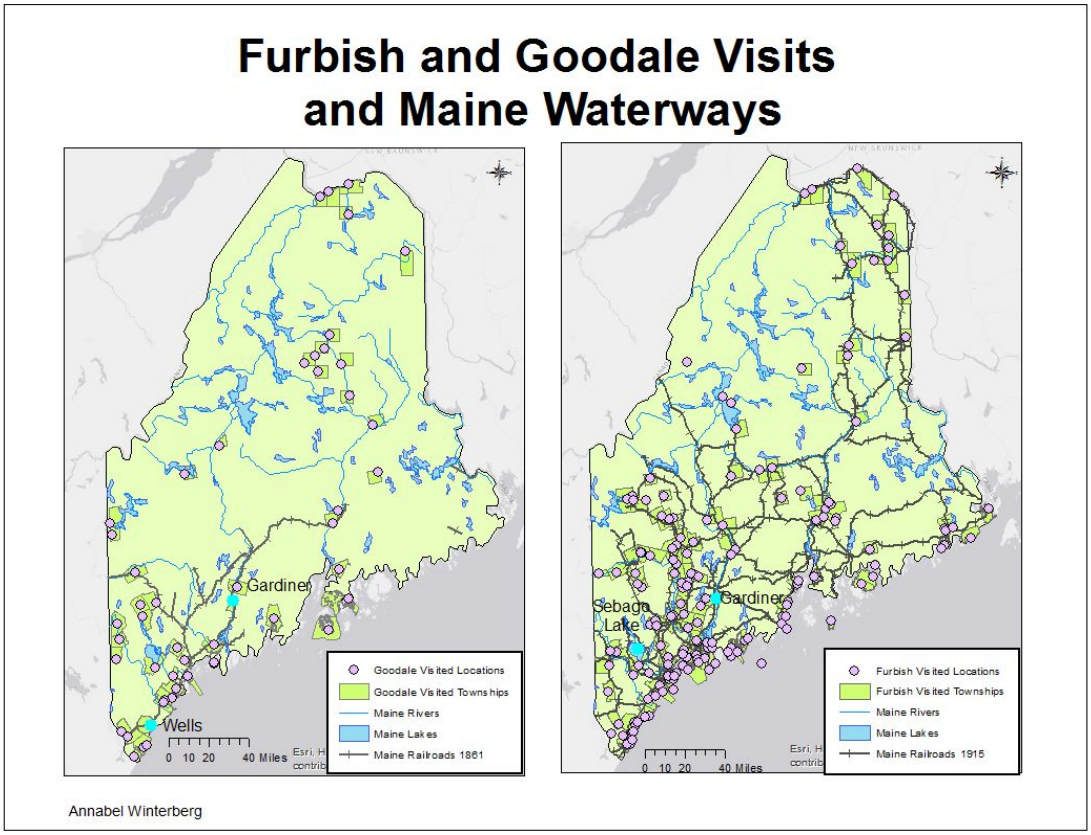

Figure 11: Locations of George Goodale visits and Maine Railroads in 1861

Figure 11 provides an explanation as to why Goodale appears to have a correlation with railroad usage and Furbish appears to have a correlation with waterway usage. This map reveals that many of Maine's railroads were also along Maine's rivers. In 186,1 approximately 68.75% of Maine's railroads intersected with rivers and this number had grown to 78.26% by 1915. This means that many of the places that Furbish and Goodale visited fell along both a railroad and a body of water. Gardiner, which is located along both the Kennebec River and the Maine Central Railroad, is a prime example. The question then becomes if the botanists were using water travel or rail travel to reach destinations like Gardiner.

Since Goodale's correlation with waterways was higher than with railroad he was likely travelling via water. This is supported by the fact that many of the locations he visited fell along just a river or lake, but very few fell just along a railroad. The inverse is true of Furbish. She has a very high correlation with railroads in comparison to rivers, and her locations are far more likely to lie just on a railroad than just on a river or lake. There are a few isolated exceptions to these trends. For instance, Goodale visited Wells which was not accessible by waterway, and Furbish found specimens along Sebago Lake. However, the general trend of these maps supports the idea that Furbish was travelling via train or stagecoach while Goodale was canoeing down rivers or lakes.

Overall, this major divergence between Goodale and Furbish speaks to the differences in how the two approached botany. In a time before massive railroad expansion, Goodale found creative ways to carry out field science. Yet, his water travel would net him far less overall scientific specimens than Furbish found using train travel. This suggests that the growth of railroads in Maine led to an increase in scientific knowledge gathering.

Furthermore, Furbish was naturally an avid outdoorswoman, but she was also a "modern" scientific woman. To elevate themselves to the level of professional scientists, women had to

find ways to be more innovative and hardworking than their male peers.[56] One way to do this could be engaging with new transportation technology that allowed better access to the field. By utilizing Maine's developing railroad networks early and avidly Furbish found an unprecedented level of success in the Maine botanical community. However, Furbish's success is also due to her eschewing modern technology. Unlike Goodale, she was willing to endure arduous stagecoach rides to find flora beyond the riverbed. For instance her 1881 trip to Aroostook was largely undertaken, "in an open wagon with no springs or backs to the seats." [57] Her willingness to undergo such strenuous activity was partially borne of a desire to finish Goodale's "incomplete" catalog.[58] Thus, the pressures placed upon Furbish as a female scientist may help to explain her travel patterns in comparison to Goodale.

Ocean Travel

Studying Furbish's waterway usage brings up a final interesting avenue of research surrounding the botanist's travel patterns. It seems likely that Furbish preferred not to journey along rivers or lakes, but little is known about how she travelled along the ocean. The Maine coast has always been one of the state's most unique areas of transportation. There were major steamboat services that ran out of Portland, Harpswell and Bar Harbor.[59] Smaller towns sometimes had local steamboat services or had small boats that could shuttle passengers.[60] We know that Furbish began to botanize heavily along the Maine coast during the last decades of her scientific career. To determine if this shift has anything to with ocean transportation, I conducted GIS analysis with the locations of Furbish's coastal visits and Maine's steamboat routes.

Coastal Townships	Percent of Townships that Intersect Ocean Routes	Average Distance to a Coastal Route

[56] Gates, 68, 72
[57] Graham, 73, 82.
[58] Graham, 77.
[59] White, 269.
[60] White, 269.

Coast Townships Furbish Visited	55.56%	4.38 miles
All Coastal Townships	42.75%	3.53 miles

Table 6: Statistical analysis of Furbish's coastal visits and Maine's coastal townships

Table 6 shows the results of the statistical analysis I conducted with Furbish's data. As usual, I calculated the percent of townships within 2 miles of a coastal route and the average distance to a coastal route. The percentage of intersection and average distance rival the lower values that Furbish had with the railroads in Table 1. However, a comparison of Furbish's values to those of all Maine's coastal towns complicates the analysis. Furbish visited coastal towns with ocean routes more than she would have at random, but not by much. Moreover, her average distance to a coastal route is actually .85 miles higher than it would be for an average township. Overall, this data suggests that Furbish may have sometimes used steamboats, but was not seeking out locations with ocean transportation as she likely did with railroads..

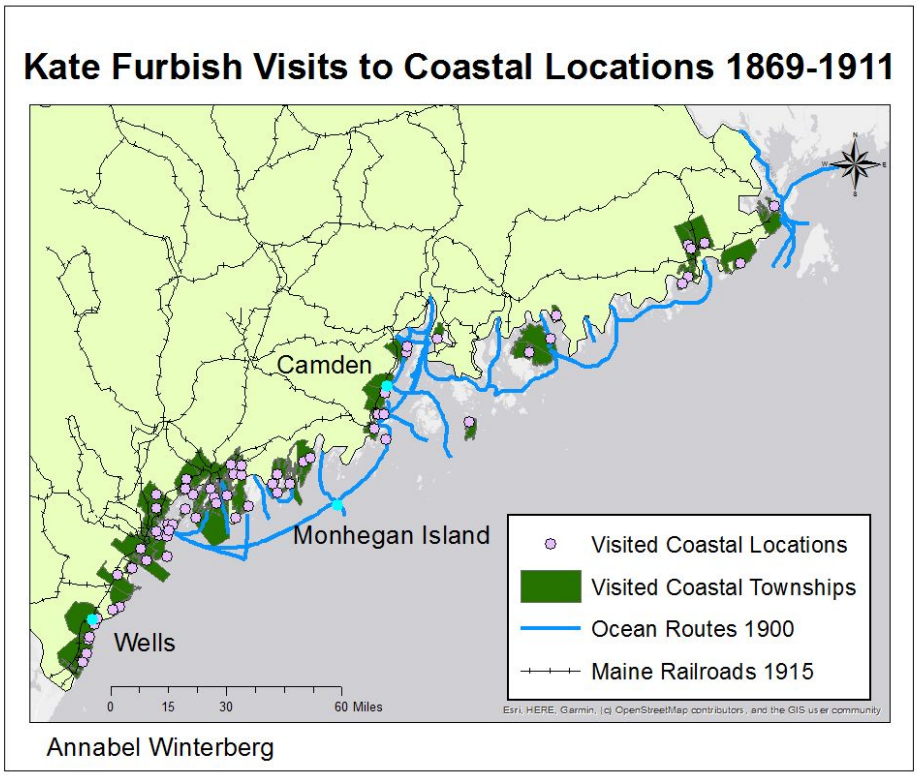

Figure 12: Coastal Townships and Locations visited by Furbish, coastal routes and Maine railroads 1915

Figure 12 adds context to these observations. First, it reveals that Maine coastal routes did not extend past Portland to the tip of southern Maine. Since these ocean roads did not stretch along the entire coast, the most efficient way for Furbish to visit southern haunts like Wells was still by train. However, there were some locations that Furbish could only reach by ocean steamboat, such as islands like Monhegan. Finally, there are some locations that were connected to both a railroad and an ocean route, like Camden. Given her unmatched correlation to the railroads, Furbish likely took the train to these places, but she still may have used steamboats to reach them before they were accessible by rail.

Overall, it seems likely that Furbish was using ocean travel some of the time. This seems to be especially true in her later years. She visited 81% of her coastal locations after 1890 and over half after 1900. Some of the last locations she ever visited were islands that required ocean travel. This likely rise in visits to steamboat-accessible locations over time coincides with the drop of visits to stagecoach-accessible locations that we see in Figures 8 and 9. This suggests that Furbish could have turned to the seaside after collecting in the remote woods proved too physically taxing. By using steamboats to reach coastal locations, she once again utilized transportation technology to further her scientific pursuits. Using a combination of train and ship travel she was able to keep cataloging long after other botanists like Goodale had retired. And it was this exceptional dedication to her work that made Furbish one of the most acclaimed male or female botanists of her day.

Conclusions

These findings have many implications for the scholarship surrounding Kate Furbish. First, they add more nuance to Vetter's hypothesis outside of the West. The example of Furbish shows that the growth of railroads in Maine could help facilitate the growth of field science. Railroads could be particularly when they were built in less inhabited areas, because they made it easier for scientists to get to reach these areas for the first time or more frequently. Trains were

also invaluable for older scientists, who could not travel as easily. However, the growth of railroads was also not the inherent mover of field scientists. Botanists such as Goodale were able to make contributions to the field without relying on transportation technology. And Furbish's most notable achievement, discovering a new species of lousewort, came when she explored the north of Maine without much railroad aid.[61] Field scientists certainly utilized transportation technology in Maine, but they were also able to navigate the field without it.

Furbish's use of ocean technology also has significance for Vetter's hypothesis. Vetter looks at railroads in the West because they were the region's primary mode of transportation.[62] However, this was not the case in Maine, which had been a bastion of sea travel long before the advent of the railroads.[63] When Furbish traveled on the ocean she was using modern steamship technology, but she was also following regional routes that existed since colonial times.[64] This suggests the growth of field science in the United States could be influenced by both national growth in transportation technology and unique regional modes of travel.

Furbish's use of the railroad also sheds light on how she engaged with travel as a female scientist.By taking the train Furbish positioned herself in the masculine realm of railroad travel without clinging to the conventions of "respectable womanhood."[65] By adopting train travel early and avidly, she was able to surpass the contributions of other male botanists. Later in life, her dual use of railroads and steamships allowed her to overcome her body's limitations and cement her place in the scientific community. Instead of allowing transportation technology to reinforce gender roles, Furish wielded it to accomplish scientific pursuits.

---

[61] Graham, 86.
[62] Vetter, 597.
[63] White, 263.
[64] White, 264.
[65] Richter, 32.

Yet, Furbish was also not beholden to technology like the other "modern women" of her day. [66] She didn't require a train car with feminine accoutrements such as parlor cars.[67] Instead she was capable of travelling in more outmoded and arduous forms of transportation like the stagecoach, so that she could cover ground that her male peers avoided. Overall, Furbish was able to accomplish her goals by both utilizing and ignoring new transportation technology, in defiance of the travel expectations set for her gender. In this way she, and other nineteenth century female scientists, can be seen as dually revolutionary. They disrupted norms and broke boundaries in both science and travel.

Traditionally, Kate Furbish has been looked at as a female botanist, but her identity as a traveller reveals new dimensions to her life. The ability to study Furbish's travel patterns through GIS sheds light on the way Furbish and her contemporaries navigated space. Kate Furbish did far more than just move from place to place, she engaged with new technology and gendered expectations to construct an identity as a scientist. The intersection of these trends on the plane of GIS gives historians a rich resource for understanding the past. Thus, by travelling throughout Maine Kate Furbish gave the world both contributions to science and contributions to history.

[66] Richter, 9.
[67] Richter, 8.

Bibliography

Chase Edward E. *Maine Railroads: A History of the Development of the Maine Railroad System.* Portland, Maine: Southworth Press, 1926.

Coburn, Louise H. *Kate Furbish, Botanist: An Appreciation*. 1924.

Cullina, Melissa. "Kate Furbish: Maine's remarkable botanical artist, botanist and plant collector." In *The Botanical Artist*, 23, no. 2 (2017): 32-33.

Gates, Barbara T. *Kindred Nature: Victorian and Edwardian Women Embrace the Living World.* Chicago: University of Chicago, 1998.

Gianquitto, Tina. *Good Observers of Nature: American Women and the Scientific Study of the Natural World, 1820-1885*. Athens: University of Georgia Press, 2007.

Goodale, George L. *A catalogue of the flowering plants of Maine.* Portland: Printed by David Tucker, 1862.

Graham, Ada and Frank Graham Jr. *Kate Furbish and the Flora of Maine.* Gardiner, Maine: Tilbury House, 1995.

Hassan, Narin. "'A Perfect World of Wonders': Marianne North and the Pleasures and Pursuits of Botany." In *Strange Science: Investigating the Limits of Knowledge in the Victorian Age*, edited by Lara Karpenko Lara and Shalyn Clagget, 62-80. Ann Arbor: University of Michigan Press, 2017.

Reidy, Michael S., & Rozwadowski, Helen M. "The Spaces In Between: Science, Ocean, Empire". *Isis,* 105, no. 2 (2014): 338-351.

Richter, Amy G. *Home on the Rails: Women, the Railroad and the Rise of Public Domesticity*. Chapel Hill: The University of North Carolina, 2005.

Vetter, Jeremy. "Field science in the Railroad Era: The Tools of Knowledge Empire in the American West, 1869-1916". *História, Ciências, Saúde-Manguinhos*, 15, no. 3 (2008): 597-613.

White, John H., Jr.. *Wet Britches and Muddy Boots: A History of Travel in Victorian America.* Bloomington: Indiana University Press, 2012.