

## Magazine Ecology: Environmental Information Infrastructures in 19<sup>th</sup> & 20<sup>th</sup> Century Periodicals

### Introduction

In the opening decade of the twentieth century, the debate over whether to dam the Hetch Hetchy Valley in Yosemite National Park, turning it into a reservoir for San Francisco, came to a climax. The battle was waged through letter writing campaigns, in the halls of Congress, and in articles in magazines such as the *Atlantic Monthly* and *World's Work*. It was led by two of the best-known environmental figures in the United States, author John Muir and Forest Service chief Gifford Pinchot. Muir, an early advocate of the importance of the integrity of whole ecosystems, supported the preservation of vast areas of wilderness for both ecological and spiritual reasons. Pinchot, a student of the French school of scientific forestry, maintained that these same areas needed to be managed in a utilitarian fashion to sustainably yield the best outcomes for the greatest number of people.<sup>1</sup> The dispute lasted throughout the administration of three different presidents and only ended with the authorization of the dam in the Raker Act in 1913.<sup>2</sup>

The dispute between Muir and Pinchot is perhaps the best known in American environmental history, having come to stand as an archetype of debates between preservationists and conservationists during the Gilded Age (c. 1877-1895) and the Progressive Era (c. 1896-1916) in the U.S. These were decades of critical changes in environmental thought and policy which saw the development of ecological science and dramatic expansions in both industrial processes and environmental protections. Yet the writing that helped to shape environmental thinking during the period, including that of authors such as George Bird Grinnell, John Burroughs, and Theodore Roosevelt, has tended to be analyzed collectively, in anthologies, rather than contextually, in their original forums and with their historical interlocutors. This limitation, driven largely by the sheer scale of materials and lack of appropriate analytical tools, has meant that little scholarly attention has been paid to the larger evolution and pluralistic nature of environmental discourse and its relationship to ecological science and environmental policy during the period from the Civil War through the beginning of

<sup>1</sup> Char Miller, *Gifford Pinchot and the Making of Modern Environmentalism*. (Washington D.C.: Island Press, 2001); Brian Balogh, "Scientific Forestry and the Roots of the Modern American State: Gifford Pinchot and the Path to Progressive Reform." *Environmental History* 7, no. 2 (2002): 198-225.

<sup>2</sup> Robert W. Righter, *The Battle Over Hetch Hetchy: America's Most Controversial Dam and the Birth of Modern Environmentalism*. (Oxford: Oxford University Press, 2005).

the first World War. The major environmental shifts during this period – influencing both human understanding of ecology and their impacts upon it – are multifaceted and require a systematic analysis to account for their historical complexity and scope.

My dissertation project uses magazines — both popular, broad audience periodicals such as *Harper's Monthly* and *National Geographic* and those concerned with underrepresented communities such as *The Council Fire* and *Arbitrator* and the *Southern Workman* – to map out the broader environmental conversation that was occurring during this period and its relationship to specific policy developments and other historical events. These magazines provide an ideal way to study this discourse as they not only published the major environmental authors of the time (including each of those mentioned above), but also served as a publishing outlet for many less well-known (though potentially still influential) writers. Magazines were an important communication technology that, when combined with transit technologies, including railroads, managed to attain a national circulation – a national information infrastructure – in a period of largely localized media. Further, as Haveman and Gardner have pointed out, the broad circulation of magazines during the period, the variety of their contexts, the plurality of their authors, and their serialized nature situated them as one of the primary vehicles for national debates and the communal development of knowledge.<sup>3</sup>

This project will use archival research and topic modeling, a computational method for tracing broad trends in the content of a textual dataset, to map the evolution of conversations about the environment within the pages of magazines during this period. Building on my development of new computational scripts to facilitate better analysis of archival materials, it will trace the relationship between writing about ecological issues in magazines and the development of specific policies and will evaluate the role of magazines within the broader systems of environmental knowledge dissemination during the period, assessing how the publishing industry framed and advanced environmental knowledge for readers.

## Literature Review

<sup>3</sup>Jared Gardner, *The Rise and Fall of Early American Magazine Culture*. (Urbana: University of Illinois Press, 2012); Heather A. Haveman, *Magazines and the Making of America: Modernization, Community, and Print Culture, 1741-1860*. (Princeton: Princeton University Press, 2015).

### Environmental Writing in Magazines

Much of the previous scholarship of environmental writing in periodicals focuses on the purpose of periodical texts, often as forums for debating and disseminating information or nascent political engagement. When reviewing the role of magazines as a site for environmental discourse and information dissemination, three trends emerge. The first, outlined by Hou, involves the creation of new fields of study or work such as the development of the field of landscape architecture by figures such as Frederick Law Olmsted and Charles S. Sargent in the pages of Boston-based *Garden and Forest*.<sup>4</sup> The second, described by Goodman, involves discussion of new scientific theories or knowledge. The prime example of this is the evolutionary debates of Louis Agassiz and Asa Gray within the *Atlantic*. As two of the leading scientific figures of the period, Agassiz and Gray's articles played an essential role in defining both the terms of the evolutionary understanding in the U.S. and perception of the magazine itself. The final trend, also exemplified by the *Atlantic*, involves public education about scientific and environmental topics as naturalist authors like John Burroughs and Henry David Thoreau, as well as explorers and government scientists like Clarence King, wove scientific elements into their literary writing, enmeshing the two in a manner at once engaging and educational.<sup>5</sup>

The second key area of literary concern in environmental periodicals focuses on such magazines as a site for political engagement with environmental policy. Between the close of the Civil War, which witnessed the creation of the first wilderness park (later Yosemite National Park), and the end of Theodore Roosevelt's second presidential term, which saw a landslide of new executive and legislative action to preserve both wild land and wildlife, the United States witnessed a dramatic change in the importance of issues of conservation, ecology, and natural science.<sup>6</sup> It was during this period that the first significant national calls for scientifically based conservation efforts began to gain traction in the public imagination and, as Nash has suggested, though the environmental advocates of the period ultimately failed to achieve their loftiest goals for

<sup>4</sup> Shen Hou, *The City Natural: Garden and Forest Magazine and the Rise of American Environmentalism*. (Pittsburgh: University of Pittsburgh Press, 2013).

<sup>5</sup> Susan Goodman, *The Republic of Words: The Atlantic Monthly and Its Writers, 1857-1925*. (Hanover: University Press of New England, 2011).

<sup>6</sup> Douglas Brinkley, *The Wilderness Warrior: Theodore Roosevelt and the Crusade for America*. (New York: Harper Perennial, 2010).

preserving vast swaths of territory, they did at least manage to get Americans “ready to be aroused. Appreciation of wild country and the desire for its preservation had spread in the closing decades of the nineteenth century from a small number of literati to a sizable portion of the population.”<sup>7</sup> However, our understanding of this arousal and desire for preservation is largely circumstantial, based in the work of a few authors. Magazines, particularly those with broad appeal like the *Atlantic* and *Scribner’s*, provide a unique avenue for understanding the expansion of environmental consciousness that occurred during this period in both their broad circulation and their publication of a wide variety of authors.

Other scholars, drawing largely upon anecdotal evidence, have focused on the relationship between magazines and environmental organizations and advocacy, including their relationship to the implementation of specific environmental policies. According to Philippon, authors and editors such as John Muir, Theodore Roosevelt, George Bird Grinnell, and Mabel Osgood Wright, writing on behalf of organizations such as the Audubon Society, Sierra Club, and Boone & Crockett Club in magazines like *Forest and Stream* and *The Audubon Magazine*, sought not only to educate readers on environmental issues, but also to alert them to the importance of conservation and advocate for specific policies; they found success with the passage of new hunting regulations and the adoption of the American Ornithologists Union’s “Model Law” for bird protection by thirty-two states.<sup>8</sup> Indeed, Merchant notes that part of Grinnell’s motivation for simultaneously editing both *Forest and Stream* and *The Audubon Magazine* was a recognition of the importance of public “agitation” for the preservation of birds through their pages.<sup>9</sup>

My dissertation uses quantitative analysis and archival research to draw together the various strands of environmental thought during the period and recontextualize them, tracing their evolution within the larger field of environmental writing. A larger part of this project involves examining the inherently pluralistic nature of environmental writing within magazines, recapturing the work of underrepresented authors and

<sup>7</sup> Roderick Frazier Nash, *Wilderness and the American Mind*, 4th ed. (New Haven: Yale University Press, 2001), 181.

<sup>8</sup> Daniel J. Philippon, *Conserving Words: How American Nature Writers Shaped the Environmental Movement*. (Athens: University of Georgia Press, 2005).

<sup>9</sup> Carolyn Merchant, *Spare the Birds!: George Bird Grinnell and the First Audubon Society*. (New Haven: Yale University Press, 2016).

weaving them back into the larger historical narrative. More remains to be done in this area, building on the work of scholars such as Merchant, in her examination of the role of periodicals such as *Forest and Stream* and the *Audubon Magazine* in creating spaces for women within their pages.<sup>10</sup> This methodological intervention allows for a more macroscopic analysis of the field during this period, engaging both its complexity and its diversity in a manner not previously possible.

### Theoretical Framework – Information Infrastructures

This data-informed approach enables a more comprehensive analysis of environmental writing in magazines and how it was situated with the larger systems of environmental knowledge dissemination – the information infrastructure – of the late nineteenth and early twentieth centuries. Combining quantitative analysis with archival research on magazine operations during this period facilitates a more systematic approach to tracing the evolution of environmental discourse and capturing the plurality of authors and perspectives. Magazines were an important precursor to the much more complex infrastructure of the information age. Analysis of the relationship between environmental science, media and communication technology, and patterns of influence in this simpler media environment will provide useful insights into both the history of the period and some of the strategies that make environmental and scientific communication effective or ineffective.

In a period with limited communications media, periodicals arguably served as one of the main forms of information infrastructure and came to be, in the word of Bowker et al., “regarded as an essential, ubiquitous service for delivery, access, and exchange of information.”<sup>11</sup> All information infrastructures, according to Star, share a common set of properties, including integration with other systems, broad reach or scope, and modularity or distributed structures.<sup>12</sup> Magazines, with their (potentially) wide circulation and

<sup>10</sup> Merchant, *Spare the Birds*.

<sup>11</sup> Geoffrey C. Bowker, Karen Baker, Florence Millerand, and David Ribes, "Toward information infrastructure studies: Ways of knowing in a networked environment." In *International handbook of internet research*. Edited by J. Hunsinger, L. Klasturp, and M. Allen, 97-117. New York: Springer, 2009, 107.

<sup>12</sup> Star, Susan Leigh, “The Ethnography of Infrastructure.” *American Behavioral Scientist* 43 no. 3 (1999): 377–91. <https://doi.org/10.1177/00027649921955326>.

interrelationship with and reliance upon transit networks, cyclical publication schedules, and frequent connection with established publishing houses, demonstrate all of these properties. Though periodical publishing during the late nineteenth and early twentieth centuries operated in a very different context from the twenty-first century systems that Bowker and Star consider, the structures addressed here are essentially nascent forms of the same types of systems; they are organized around the acquisition, curation, combination, and dissemination of content and thus have potentially important implications for analogous twenty-first century systems.

My project is most concerned with the *embeddedness* of magazines – their integration into existing systems of knowledge production and dissemination – and their *reach or scope*, in terms of overall circulation and intended audiences, in order to delineate their role within the larger environmental information infrastructures during this time period. Magazines were heavily reliant upon their integration with national communications networks such as rail and postal networks in order to facilitate the distribution of environmental information, even as they were individually enmeshed with specific systems such as *National Geographic's* tight integration with government science or the *Southern Workman's* ongoing relationship with the Hampton Normal and Agricultural school. These types of relationships were important for both the creation and the diffusion of knowledge about the environment and highlight the fact that, as Star and Ruhleder argue, infrastructures are fundamentally relational.<sup>13</sup> My project seeks to understand periodical publishing in light of this relationality, using both quantitative and qualitative analyses to map out relationships in both the environmental content and organizational operation of these magazines.

Similarly, the relative reach of different periodicals, both in terms of knowledge creation (through access to resources like government or university scientists or specific authors) and knowledge dissemination (through access to the latest printing technologies, transit systems, etc.), has a significant effect on their impact on environmental consciousness in the United States.<sup>14</sup> Brulle argues that such impacts cumulatively

<sup>13</sup> Susan Leigh Star and Karen Ruhleder, "Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces." *Information Systems Research* 7, no. 1 (1996): 111-134.

<sup>14</sup> Reach and scope are, within my project, more anecdotal than statistical. Though there are some solid circulation numbers for individual magazines, specific distribution records for each are sparse and national tracking of

evolve into environmental discourse, which in turn serves as the foundation for collective action or organization around environmental issues that have real-world implications.<sup>15</sup> Integrations with different systems and changing technologies (and access to them) such as rail networks, the postal system, and telegraphy, influenced the reach of magazines and, thus, their impact on their audience both individually and collectively. The greater the reach of individual magazines, the greater their ability to provide this cultural basis and, ultimately, to influence behaviors and policy.

Through these two elements – embeddedness and reach/scope – I will extend the previous, largely anecdotal work on the influence of environmental writing in magazines to understand their role within what John refers to as the *information environment*, “the far-reaching yet often subtle ways in which information infrastructure has shaped, and continues to shape, institutional patterns and cultural norms.”<sup>16</sup> Such analysis will contribute to our understanding of how cultural approaches to the environment develop, how networks of influence operate or fail to operate among individual authors and publishing organizations, and how different ways of knowing about the environment are represented.

## Research Questions

In essence, my dissertation will describe the way that magazines facilitated the expansion of environmental discourse in the United States during this period by delineating the circulation and distribution of periodicals (*how* information was conveyed) and by analyzing their content (*what* information was being conveyed). My analysis will include close reading of original articles, exploration of archival material, and topic modeling; my specific research questions are:

these numbers did not occur until the establishment of the Audit Bureau of Circulations (ABC) in 1914, the data from which has been deployed by the NEH-funded “Circulating American Magazines Project” (Macklay 2017). Based on the archival sources available, the analysis of reach within my project will consist of both the available statistics and the intended audience of the publications as revealed through both archival resources and the texts themselves.

<sup>15</sup> Robert J. Brulle, *Agency, Democracy, and Nature: The U.S. Environmental Movement from a Critical Theory Perspective*. (Cambridge: The MIT Press, 2000).

<sup>16</sup> Richard R. John, “Recasting the Information Infrastructure for the Industrial Age,” in *A Nation Transformed by Information: How Information has Shaped the United States from Colonial Times to the Present*. Ed. Alfred D. Chandler Jr. and James W. Cortada (Oxford: Oxford University Press, 2000), 56.

- 1) How can we measure the flow of environmental information through the infrastructure of periodicals? What kinds of strategies were deployed by publishers and editors to cultivate, curate, and disseminate information about the environment to their reading publics between 1850 and 1908?
- 2) What were the most frequent topics related to the environment that authors wrote about during this period and how did they change over time?
- 3) How were these foci framed within the contexts of individual magazines and how did some of these specific framing patterns represent a response to circumstances such as an individual author's influence, a magazine's imagined readership, or evolving ecological understandings?
- 4) Within the context of existing scholarship on American environmental history, what do these patterns in both environmental topics and strategies for communicating them tell us about the relationship between scientific and environmental communication and policy?

The dissertation project that I envision will address my research questions in four chapters. The first chapter will draw on current scholarship and archival sources to examine the circulation and distribution of magazines, describing how the periodical publishing industry functioned within the larger information infrastructure of the period and implications for the efficacy of similarly pluralistic scientific communications in our present moment. This chapter will focus on Star's "embeddedness" of infrastructure – on the integration of periodical publishing and distribution with other networks such as rail, postal, and telegraph networks. By examining how physical magazine production, distribution, and consumption was facilitated by publishers and how it changed over time, this chapter will clarify the flow of information within the industry, tracing its path from the scientist's bench to the original text produced at the author's desk through the teams of editors, illustrators, engravers, typesetters, teamsters, and others who ultimately convey it to readers. Tracing this process, in combination with visualizations of the relational organization of the topics, will provide not only a broader, but also a more longitudinal history of environmental writing and its relationship to policy than has previously been possible.



The subsequent chapters will trace the types of information that flowed through these channels and how they were facilitated intellectually and literarily. I will use Latent Dirichlet Allocation (LDA), a form of topic modelling, to analyze, visualize, and trace the evolution of writing about topics related to the environment, identifying major trends and themes in environmental writing both within and across different periodicals.<sup>17</sup> The patterns that emerge from this analysis will guide subsequent textual analysis of specific articles and magazine issues to identify how these topics were conveyed and understood by the authors themselves. This analysis will be paired with case studies drawn from archival research that accounts for how specific authors and editors understood their role in information dissemination and their conception of the imagined reading publics.

This approach – integrating physical infrastructures, discursive patterns, and original materials – enables a systematic view of the role of periodical publishing within the development of American environmental literature. By juxtaposing physical production and distribution with both close and distant reading methods, my project accounts for both the content of the magazines and the contexts that shaped them to provide a more systematic view of the way that knowledge about the environment was represented, shared, and disseminated during this time through the infrastructure of magazines.

## **Data & Methods**

My specific dataset for completing this analysis is drawn from periodicals whose complete or near complete runs have been digitized or transferred to microfiche for accessibility and includes representative samples from a variety of different types of publications with non-specialized, generalist content, including both those magazines with wide, general circulation, and smaller magazines with much narrower imagined reading publics. Collectively, this dataset provides the most representative possible cross section of the generalist magazines from this period that are available, accessible, and complete in existing archives and includes the following periodicals:

<sup>17</sup> Blei, David M, Andrew Y. Ng, and Michael I. Jordan, “Latent Dirichlet Allocation,” *Journal of Machine Learning Research* 3 (2003): 993-1022.

- 1) *Harper's New Monthly Magazine* (1850-present): Founded in New York City by the Harper & Brothers publishing house, *Harper's New Monthly Magazine* (renamed *Harper's Monthly Magazine* in 1900) is the longest continuously published magazine in the United States and one of the "big three" magazines of the late nineteenth century. With a large, national circulation (starting at around 50,000 and expanding to 200,000 by the outbreak of the Civil War), *Harper's* cultivated a broad, national readership and became, according to *The Nation*, "an index to the literary culture and general character of the nation."<sup>18</sup>
- 2) *Scribner's Monthly/The Century Magazine*: Founded in Boston under imprint of Charles Scribner's Sons and under the editorship of Dr. Josiah Gilbert Holland, *Scribner's* (and its successor, the *Century*) published many notable authors of the period, including Rebecca Hardin Davis, Hans Christian Andersen, Julian Hawthorne, John Burroughs, John Muir, Clarence King, John Wesley Powell, Theodore Roosevelt, William Dean Howells, Henry James, John Hay, and Jack London. Disputes between the book and magazine publishing arms of Scribner's caused the magazine to be sold in 1881 and become *The Century Illustrated Magazine*.<sup>19</sup> It ultimately reached a peak circulation of around 200,000 by the end of the 1880s, though it maintained a circulation of well over 100,000 all the way through the first decade of the twentieth century. According to Frank Luther Mott, "the *Scribner-Century Magazine* was of great importance in the development of American literature throughout a life of sixty years, and its pages are filled with materials of significance for the study of American life in that period."<sup>20</sup>
- 3) *The Overland Monthly* (1883-1935): Founded in San Francisco by Anton Roman in 1868, the first series of the *Overland Monthly* quickly thrived under the editorship of Bret Harte and just as quickly stagnated when Harte absconded in 1871. The *Overland* was reborn in a second series after a merger with the *Californian* in 1883 and ultimately attained solid circulation numbers around 30,000 by 1900.<sup>21</sup> Though it emphasized writing by authors from California and was always closely tied to the University of

<sup>18</sup> Frank Luther Mott, *A History of American Magazines, Volume III:1865-1885*. (Cambridge: Harvard University Press, 1938), 405.

<sup>19</sup> Mott, Frank Luther, *A History of American Magazines, Volume II:1850-1865*. (Cambridge: Harvard University Press, 1938), 480.

<sup>20</sup> Mott, *A History of American Magazines, Volume III*, 467.

<sup>21</sup> Mott, *A History of American Magazines, Volume III*, 408.

California, “it kept abreast of current affairs, and it published departments of book reviews and general editorial comment. Some illustrations entered its pages in the late eighties.”<sup>22</sup> Having published a variety of western writers including Mark Twain, Clarence King, Willa Cather, and Jack London, the *Overland* brings greater regional diversity to this dataset in addition to its significant circulation numbers.

- 4) *National Geographic Magazine* (1888-present): Created with the foundation of the National Geographic Society in 1888, *National Geographic* was dedicated to “the increase and diffusion of geographic knowledge.”<sup>23</sup> Based in Washington, D.C. and intimately connected with government science organizations, *National Geographic* came to rely on a member-subscriber model that funded both the magazine and the Society’s scientific and exploratory endeavors. Though membership was relatively stagnant under the leadership of its first editor, Gardiner Greene Hubbard, it took off after 1897 when Gilbert Grosvenor became editor, a position that he held until 1954.<sup>24</sup> With its connections to government science and leading scientific thinkers of the day, its long-term influence on American magazine publishing, and its editors’ early willingness to “strike out on new and non-academic roads in geographic science,” *National Geographic* is a valuable addition to this dataset as a scientifically oriented, non-technical magazine that offered a broad approach to environmental topics through the lens of geographic science.<sup>25</sup>
- 5) *The Council Fire and Arbitrator* (1878-1889): Based in Washington D.C., and founded and edited by A.H. Mecham, the *Council Fire and Arbitrator* was, per its masthead, a “monthly journal devoted to the civilization and rights of the American Indian.” The inclusion of this magazine integrates Native American perspectives as well as European American perspectives on Native issues into the dataset. It explicitly brings issues of land settlement and Native rights into conversations about ecology during the period that saw a significant changes to the status of indigenous lands including such legislation as the Dawes Act of 1887 and the Nelson Act of 1889, both of which made it easier to remove Native

<sup>22</sup> Mott, *A History of American Magazines, Volume III*, 407.

<sup>23</sup> Frank Luther Mott, *A History of American Magazines, Volume IV:1885-1905*. (Cambridge: Harvard University Press, 1957), 620.

<sup>24</sup> Mott, *A History of American Magazines, Volume I*, 632.

<sup>25</sup> Mott, *A History of American Magazines, Volume I*, 621.

peoples from their lands. This magazine is one of the few extant periodicals focused on Native issues from this period and is a forerunner of the large number of Native periodicals that were founded during the latter half of the twentieth century.

- 6) *The Southern Workman* (1881-1939): Published in Hampton, Virginia by the Hampton Normal and Agricultural Institute, a school for African Americans created during Reconstruction – it later became Hampton University) and hosted a Native American education program beginning in 1878 – *The Southern Workman* was “devoted to the industrial classes of the south” and was written primarily both by and for working class African Americans.<sup>26</sup> This magazine adds valuable racial and cultural as well as regional and class diversity to this dataset.

To map out the topics contained within the dataset above, both topically and historically, I will bring together archival research of extant internal documents from the above periodicals with quantitative analysis of the full texts of the articles. This combination of methods will illuminate broad patterns in the shape of writing about topics with environmental implications during the period, as well as provide case studies concerning *how* and *why* creators chose to approach their topics in specific ways and how readers responded to them. By bringing these methods together, it will be possible to trace the evolution of environmental discourse during this period, as well as the forces that shaped it, including the extent to which it demonstrates a reciprocal relationship with environmental policy (i.e. the extent to which writers help to shape the public agenda and the extent to which policy developments influenced what authors wrote about).

### Archival Research

In addition to analyzing portions of individual articles within the magazines listed above (in response to topical pattern and changes over time revealed by the quantitative analysis), I will also conduct research at many of the publisher’s archives. These include materials from *The Overland Monthly* at the Bancroft Library at U.C. Berkeley, from *Scribner’s Monthly* at the Firestone Library at Princeton, from *The Century* at the New York Public Library, from *Harper’s* in the Columbia University Special Collections, from *National Geographic* at the

<sup>26</sup> Hampton University, History, 2019. <http://www.hamptonu.edu/about/history.cfm>.

National Geographic Archives and Library in Washington D.C.<sup>27</sup> This research will focus on internal documents such as editorial memoranda, accounting records, and correspondence with publishers and authors to clarify both the imagined reading public of individual magazines and the authors' and editors' conception of their role in information creation and dissemination. Reviewing these internal documents will provide new insights into the ways that individual content creators, editors, and publishers understood their roles and work. Such individual documentation will complement the quantitative elements by facilitating both macroscopic and microscopic analysis in ways that have not previously been possible.

Through communication with the archives and exploration of their finding aids and internal documentation, I have confirmed access to the necessary materials. Though the records vary in detail and completeness, together these archival materials should provide a sampling of the ways that magazine producers understood and approached their magazines as vehicles for the dissemination of knowledge and culture and how they navigated the various systems that their magazines were enmeshed within to facilitate their distribution.

### Topic Modeling

The quantitative analysis portion of my project will utilize Latent Dirichlet Allocation (LDA), a method of quantitative analysis developed by David M. Blei that uses a Bayesian probabilistic model to identifies topical patterns within textual data and determines how much each text is “about” the identified topics. Topic modeling is essentially a linguistic equivalent of assigning seating at a wedding where words are individual guests and topics are tables; based on a predetermined number of tables (topics) the analysis iteratively sorts guests (word patterns) into tables balancing the imperatives (the strength of which can be adjusted) of compatibility between guests with that of having about the same number of guests at each table. Building on my previous coursework and training in Python, including both foundational computational courses and specialized coursework on natural language processing, I will use the Gensim Python package to

<sup>27</sup> I have not yet been able to identify any archive holding internal materials for either *The Southern Workman* or *The Council Fire and Arbitrator*.

complete this analysis, following the process outlined by Li on my dataset of textual corpus of environmental articles.<sup>28</sup> This dataset will be culled from the corpus of all magazine articles within the larger dataset described above. This will be done in part using the environmental keyword dictionary developed by Lisa Swanstrom and which she has offered to share with me. I will expand this dictionary iteratively from sources such as the Library of Congress subject headings and other indexes, in addition to the topics generated by an LDA analysis of the corpus of *Scribner's Monthly* articles that I have built during the course of previous research. This work will extend some of the topic modeling research of Christopher Oscarson whose analysis of the writing of Swedish author Selma Lagerlof provides a valuable precedent for the ways that the results of topic modeling analysis – such as topical cluster lists, network analysis of topics, and “aboutness” graphs measuring alignment of specific texts with each topic – can be deployed for literary analysis.<sup>29</sup>

Topic modeling has been deployed in a few similar projects, most notably Robert K. Nelson's *Mining the Dispatch* project, which uses topic modeling to trace the evolution of content in the *Richmond Daily Dispatch* during the Civil War.<sup>30</sup> This methodology is best suited to my particular project as it allows for a macroscopic analysis of the complete or mostly complete runs of each magazine both individually and as a collective whole. Relying on topic modeling, in combination with archival research, situates the texts within the language of the period, what Latour refers to as *infralanguage*, the terminology and patterns that are deployed by the actors themselves, rather than those assigned retrospectively by scholars.<sup>31</sup> In this way, I can be sure that that language used, and the topics generated, represent the broad patterns of understanding of the period, tracing the relations and evolutions of environmental topics as they are represented by the texts themselves rather than as 21<sup>st</sup> century observers would understand them. This is particularly important within the context of writing about environmental topics given the significant shifts that have occurred in the language and conceptualization of these topics since the mid-nineteenth century, including the fact that the usage of

<sup>28</sup> Susan Li, “Topic Modeling in Python with NLTK and Gensim.” *Towards Data Science*. Mar 30, 2018, <https://towardsdatascience.com/topic-modelling-in-python-with-nltk-and-gensim-4ef03213cd21>

<sup>29</sup> Christopher Oscarson. “The Selma Lagerlof Project.” Nordic Digital Humanities Lab. 2018, accessed 26 July 2019. <http://nordicdh.org/>

<sup>30</sup> Richard K. Nelson, “Mining the Dispatch.” Digital Scholarship Lab, University of Maryland, accessed 28 July 2019. <http://dsl.richmond.edu/dispatch/articles/view/15377>

<sup>31</sup> Bruno Latour, *Reassembling the Social: An Introduction to Actor Network Theory*. (Oxford: Oxford University Press, 2007).

“environmental” to describe topics related to ecology, conservation, and natural systems did not come into common usage until after WWII.<sup>32</sup> The linguistic analysis afforded by topic modeling allows, for the first time, a historical analysis that maps out the conceptual schema of the period, facilitating new types of comparison to better understand the evolution of environmental discourse in the United States.

### **Feasibility and Timeline**

This project involves two main, interrelated components. The quantitative element involves the manipulation of the full text articles that have been received from the HathiTrust Digital Library and full text scans from other archival sources which will be completed over the summer and into the fall of 2019. During this time, I will also be working on the first chapter, which describes the historical role of environmental writing within periodicals, the internal flow of information within periodicals, and the systems of magazine distribution and circulation that existed during this period. This initial data formatting and organization will rely on the development of Python scripts used to delineate the concatenated full texts volumes into specific articles that can then be sorted into broad environmental or non-environmental categories using an expanded version of the environmental topic dictionary initially developed by Lisa Swanstrom. During this portion of the project, I plan to rely on and build from the scripts developed by Dr. Nicolas Kelly and Nikki White at the University of Iowa specifically for working with HathiTrust materials. Building on my previous training and with the support of the University of Iowa Digital Scholarship & Publishing Studio, I am in the process of developing the necessary scripts. In the event that these scripts are not workable for each of the periodicals as a result of either limitations with the accuracy of the optical character recognition of the full text scans or as a result of inconsistencies or inaccuracies within the metadata, I will shift my approach to running the analysis on a smaller set of manually split texts or on corpora of issues from a specific time period (guided by my archival work) and on the larger, undivided corpus, adjusting the parameters of the topic modeling until one or more environmentally related topics emerges that I would then be able to focus on in my analysis.

<sup>32</sup> Paul Warde, Libby Robin, and Sverker Sörlin, *The Environment: A History of the Idea*. (Baltimore: Johns Hopkins University Press, 2018).

During the second stage of the quantitative part of the project, I will run the actual analysis on my dataset and complete most of the archival research for the project. This portion of the project will occur throughout the remainder of fall 2019 and 2020. In this portion of the project, I will begin to develop the visualizations that would eventually be included in my dissertation and on my website. The analysis and preliminary development of visualizations should be near complete by May of 2020. During this portion of the project, I would also to complete the research trips to the periodicals archives that I have identified. Completing the preliminary quantitative and archival research during the same period allows them to inform one another and also leaves sufficient time for refinements and fine tuning of analysis during the subsequent write-up stage.

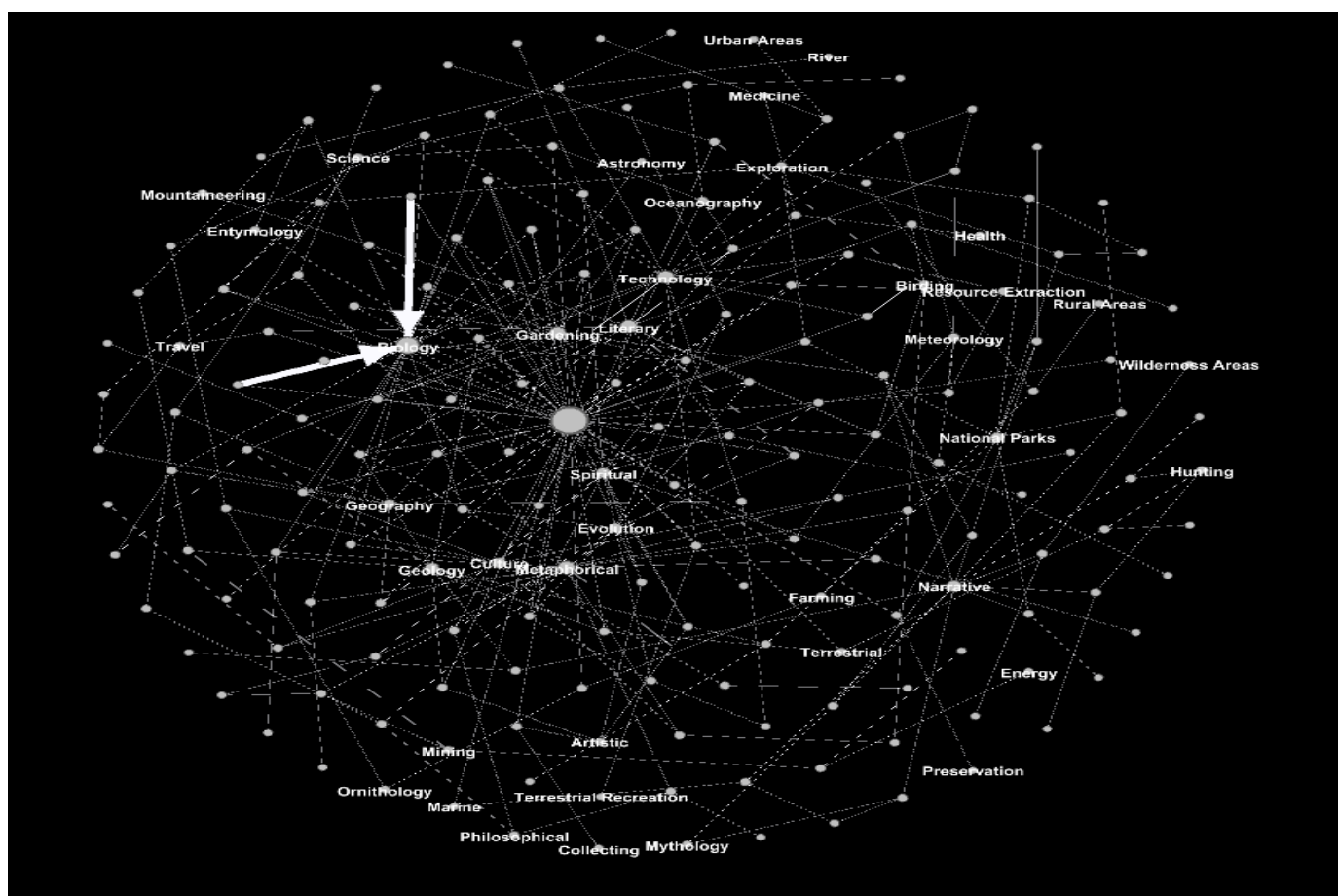
The qualitative component of this project involves archival research and close readings of individual articles and issues. This part of the project will be guided by both my research questions on the flow of information and decision making within periodical organizations, public responses to writing on environmental topics, and their relationship to the development of specific policies. This analysis will also be informed by the preliminary results of my quantitative data as well. This portion of the research will begin with the preliminary draft of the first chapter in the summer and fall of 2019 and continue throughout the project, utilizing some of the results of the quantitative research to inform both close reading and archival research during the latter stages of the project. After the preliminary archival research and topic modeling is completed, these two lines of inquiry will converge, with each informing the other as both the topic modeling and close reading in the data-informed chapters is further refined and revised. Ultimately, the three main chapters will combine historically contextualized topic modeling with data-informed close readings. The qualitative elements and drafting of the chapters should be completed by the beginning of spring 2021, leaving the remainder of the semester for revisions and the compilation of the accumulated documentation on script development and operation and the analytical parameters and results of topic modeling.

### **Preliminary Work and Preparation**



My scholarly training has prepared me for the various elements of this project in a variety of ways. As a doctoral candidate in English, much of my training has focused on the close reading, literary analysis, and archival work that makes up a significant portion of my project. I have previously worked with materials in archives and special collections and am familiar with the policies and procedures governing such institutions. Further, as a master's candidate in library and information science, I have also received the training in archival theory, organization, and information systems that will allow me to effectively navigate both the digital and analog systems necessary to complete this project.

Beyond the training that I have received for my degrees, I have also completed a Public Digital Humanities certificate that exposed me to a variety of digital methods and their theoretical groundings. In addition to the coursework for this certificate program, I also completed a capstone project under the



*Figure 1: Network Diagram of Environmental Topics in Scribner's*

supervision of the University of Iowa Digital Scholarship & Publishing Studio, during which I performed

preliminary work for this project by analyzing and created visualizations related to the categorization and networks of topics in the environmental materials published by *Scribner's Monthly*. Figure 1 shows some of the preliminary results of the manual coding of the articles within an environmental writing taxonomy and their relationality. This preliminary work provided me with a better understanding of the content and organization of the magazines, strategies for data organization and key metadata components, and a sense of the large amount of environmentally oriented authors and magazine articles during the period. I further capitalized on this preliminary experience during a Digital Scholarship & Publishing Studio Summer Fellowship where I worked closely with a digital humanities librarian to expand my project and experiment with several different strategies for answering my research questions. This pilot version allowed me to hone my research methods and develop more efficient and effective workflows that I can now fully implement for my dissertation project.

Full text versions of many of the periodicals that I plan to include in my analysis are stored in the HathiTrust Digital Library, and I have secured copies of these files. For the non-digitized periodicals that I plan to use, I have been in contact with Lee Grady, a reference archivist at the Wisconsin Historical Society, which houses one of the largest Native American periodical collections in North America. This preliminary groundwork in place allows me to proceed with my textual analysis to further archival research from the corporate archives of the periodicals at the Bancroft Library at U.C. Berkeley, the Firestone Library at Princeton University, the National Geographic Society Library and Special Collections in Washington, D.C., and the Columbia University Archives and Special Collections. I have communicated with these archives and/or reviewed their finding aids to ensure the efficiency of my research visits.

### **Intellectual Merit**

Periodicals provide one of the best windows into the process of information dissemination and the development of community intellectual life during the period leading up to the massive shifts in environmental policy that occurred during the Gilded Age and Progressive Era. As Anderson has argued, the

printer's office is the "key to North American communications and community intellectual life."<sup>33</sup> Scholars such as Philippon and Merchant have described the role of magazine authors in shaping both public consciousness and public policy regarding the environment, but previous work has necessarily focused only on a small subset of authors and their contributions. By drawing upon big data tools for textual analysis, my project provides a much more comprehensive picture of the nature of environmental writing during the period – one that focuses not just on a small subset of homogenous, canonical authors, but rather on a larger national dialogue that evolved within the context of magazines.

The utilization of topic modeling in my project will allow me to identify and examine the writing of a much wider variety of authors, including women and people of color, and to tell the story of their contributions to and perspectives on environmental thought. This represents an important intervention in the environmental history of the United States because it provides a broader and more contextualized history of the environmental thought and writing during the period. It considers environmental writing not in tidy anthologies, but in its original, highly pluralistic context, and within the particular technological and economic systems that shaped the way that authors wrote and what they wrote about. These systems indirectly shaped the course of U.S. environmental history, the role of scientific communication in debates about public policy, and the process for coordinating and disseminating scientific information.

Finally, in the development of Python scripts that can be used for the preparation of periodical corpora, my project makes a potentially significant technical contribution to the field of periodicals and print studies and to historical and social scientific fields reliant upon large scale textual analysis. While projects such as Google Books have managed to digitize a great many periodicals, most exist in formats that present significant challenges to work with, particularly for periodicals scholars who need to both concatenate and split the texts with which they are working. Creating model scripts that can be deployed to complete these tasks for large periodical corpora and sharing them via GitHub will facilitate the work of other scholars and enable significant expansion of digital research into historical textual information.

<sup>33</sup> Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. (New York: Verso, 1983, 2016), 61)

## Broader Impacts

As we work to confront the environmental challenges of the 21st century, including issues such as environmental protection, energy security, and land conservation, understanding environmental history and the way that communication about environmental topics shapes public opinion and, ultimately, policy only becomes more important. In exploring the ways that people thought about the environment and advocated for environmental change during the late nineteenth and early twentieth century, particularly in regards to the ways that people built upon or expanded scientific literacy related to the environment, my project offers valuable perspectives about how people engaged with and confronted the environmental challenges of the past. Further, the emphasis on resurfacing too-often overlooked perspectives on and engagements with the environment by those such as women and people of color, will contribute to a more nuanced, pluralistic understanding of environmental discourse during this time and of the pluralistic and democratic possibilities in our own moment. The writing of this historical period, as authors and scientists developed new ideas about preservation, sustainability, environmental degradation, and ecology in the lead up to the dawn of the twentieth century, represents an important precedent in addressing the challenges that we face as we move further into the twenty-first century.

I plan to share the results of my work in both academic publications such as *Environmental History*, *ISLE: Interdisciplinary Studies in Literature and Environmental*, and *Technology and Culture* and public-facing outlets such as the Center for History, Culture, and Environment's *Edge Effects Magazine* and through discussions of the benefits of humanistic understanding of scientific research in *Inside Higher Ed*, where I am a contributing author. I also hope to be able to share my work, particularly as it relates to the importance of the collaboration between the environmental humanities and sciences, in public forums such as Iowa City's Darwin Day, an annual event celebrating the contributions of the sciences to humanity that includes scientists and other scholars from around the country. Finally, as part of a larger commitment to integrate my research and teaching (demonstrated by my ongoing involvement in Iowa's CIRTL initiative), I will share the teaching materials that I develop during the course of my project (including lesson plans, bibliographies, and some

sample datasets) on my own website and through the Association for Literature and the Environment (ASLE's) teaching materials archive. This will be done under a Creative Commons license after the project is completed so that the materials can be used and adapted by other instructors at the high school and undergraduate levels.

### References Cited

- Anderson, Benedict. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. New York: Verso, 1983, 2016.
- Balogh, Brian. "Scientific Forestry and the Roots of the Modern American State: Gifford Pinchot and the Path to Progressive Reform." *Environmental History* 7, no. 2 (2002): 198-225.
- Blei, David M, Ng, Andrew Y., and Jordan, Michael I. "Latent Dirichlet Allocation," *Journal of Machine Learning Research* 3 (2003): 993-1022.
- Bowker, Geoffrey C., Karen Baker, Florence Millerand, and David Ribes. "Toward information infrastructure studies: Ways of knowing in a networked environment." In *International handbook of internet research*. Edited by J. Hunsinger, L. Klastrup, and M. Allen, 97-117. New York: Springer, 2009, pp. 97-117.
- Brinkley, Douglas. *The Wilderness Warrior: Theodore Roosevelt and the Crusade for America*. New York: Harper Perennial, 2010.
- Brulle, Robert J. *Agency, Democracy, and Nature: The U.S. Environmental Movement from a Critical Theory Perspective*. Cambridge: The MIT Press, 2000.
- Gardner, Jared. *The Rise and Fall of Early American Magazine Culture*. Urbana: University of Illinois Press, 2012.
- Goodman, Susan. *The Republic of Words: The Atlantic Monthly and Its Writers, 1857-1925*. Hanover: University Press of New England, 2011.
- Hampton University, History, 2019. <http://www.hamptonu.edu/about/history.cfm>.
- Haveman, Heather A. *Magazines and the Making of America: Modernization, Community, and Print Culture, 1741-1860*. Princeton: Princeton University Press, 2015.
- Hou, Shen. *The City Natural: Garden and Forest Magazine and the Rise of American Environmentalism*. Pittsburgh: University of Pittsburgh Press, 2013.
- John, Richard R. "Recasting the Information Infrastructure for the Industrial Age," in *A Nation Transformed by Information: How Information has Shaped the United States from Colonial Times to the Present*. Edited by Alfred D. Chandler Jr. and James W. Cortada, 55-106. Oxford: Oxford University Press, 2000.

- Latour, Bruno. *Reassembling the Social: An Introduction to Actor Network Theory*. Oxford: Oxford University Press, 2007.
- Li, Susan. "Topic Modeling in Python with NLTK and Gensim." *Towards Data Science*. Mar 30, 2018, <https://towardsdatascience.com/topic-modelling-in-python-with-nltk-and-gensim-4ef03213cd21>
- Macklay, Kathleen. "Visualize this: Project shows U.S. magazine evolution." *Berkeley News*, August 14, 2017, <https://news.berkeley.edu/2017/08/14/visualize-this-project-shows-u-s-magazine-evolution/>
- Merchant, Carolyn. *Spare the Birds!: George Bird Grinnell and the First Audubon Society*. New Haven: Yale University Press, 2016.
- Miller, Char. *Gifford Pinchot and the Making of Modern Environmentalism*. Washington D.C.: Island Press, 2001.
- Mott, Frank Luther. *A History of American Magazines, Volume II:1850-1865*. Cambridge: Harvard University Press, 1938.
- . *A History of American Magazines, Volume III:1865-1885*. Cambridge: Harvard University Press, 1938.
- . *A History of American Magazines, Volume IV:1885-1905*. Cambridge: Harvard University Press, 1957.
- Nelson, Richard K. "Mining the Dispatch." Digital Scholarship Lab, University of Maryland, accessed 28 July 2019. <http://dsl.richmond.edu/dispatch/articles/view/15377>
- Nash, Roderick Frazier. *Wilderness and the American Mind*, 4th ed. New Haven: Yale University Press, 2001.
- Oscarson, Christopher. "The Selma Lagerlof Project." Nordic Digital Humanities Lab. 2018, accessed 26 July 2019. <http://nordicdh.org/>
- Philippon, Daniel J. *Conserving Words: How American Nature Writers Shaped the Environmental Movement*. Athens: University of Georgia Press, 2005.
- Righter, Robert W. *The Battle Over Hetch Hetchy: America's Most Controversial Dam and the Birth of Modern Environmentalism*. Oxford: Oxford University Press, 2005.
- Star, Susan Leigh. "The Ethnography of Infrastructure." *American Behavioral Scientist* 43 no. 3 (1999): 377–91. <https://doi.org/10.1177/00027649921955326>.
- Star, Susan Leigh, and Karen Ruhleder. "Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces." *Information Systems Research* 7, no. 1 (1996): 111-134.

Warde, Paul, Robin, Libby, and Sörlin, Sverker. *The Environment: A History of the Idea*. Baltimore: Johns Hopkins University Press, 2018.