Thinking Like a Floodplain:
Water, Work, and Time in the Connecticut River Valley, 1790-1870

By
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Jared S. Taber

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Chairperson Sara M. Gregg

Gregory T. Cushman

Edmund P. Russell

Robert J. Gamble

Peggy A. Schultz

Dorothy M. Daley

Date Defended: 28 April 2016

The Dissertation Committee for Jared S. Taber
certifies that this is the approved version of the following dissertation:

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Chairperson Sara M. Gregg

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Abstract

Residents of the nineteenth-century Connecticut River Valley learned the character of the river, and water more broadly, through their labor. Whether they encountered water in the process of farming, shipping, industrial production, or land reclamation, it challenged them to understand its power as both an object outside their control and a tool that facilitated their work. This awareness of water's autonomy and agency necessitated attention to how water's flow varied across timescales ranging from seasons, through historical precedents in working with water, and into the geological processes whereby the river shaped the contours of the Connecticut River floodplain and the valley as a whole. Communities mobilized this knowledge when explaining the limitations that ought to circumscribe novel water uses and trying to maintain the river's status as a common tool shared among diverse bodies of users. This converted working knowledge of water's flow into a political tool that both criticized and shaped industrialization. This dissertation asks how people knew the river as a common resource shared between independent communities and how the deployment of this knowledge—and the attendant political power that it carried—shaped the character of industrialization in the valley. It uses sources ranging from weather diaries to corporate records and municipal petitions to uncover patterns of local knowledge about water use and explore their influence on the politics of industrialization between 1790 and 1870.

The temporalities that people saw underlying geological, and seasonal variations in the flow of water on the landscape, shaped how they responded to interventions on the landscape such as the construction of dams or bridges, alterations to the channel, or changes to drainage. When assessing these proposals, people looked beyond the immediately visible consequences of

these interventions on the landscape. Understanding how water had flowed in the past helped people to imagine how it might flow in the future, and this imaginative viewpoint on the landscape shaped everything from farming practices to the design of water power dams in the nineteenth century valley. To document these accounts of the flow of water in everyday life, this dissertation uses a variety of sources. When accounting for individual perspectives on the flow of water, it looks at weather diaries—which used the flow of water as a heuristic tool for understanding seasonal change. When accounting for societal perspectives, it folds in accounts of the valley's physical geography—which relied on information from ordinary people who understood water's power as a geological force. When examining the political ramifications of these perspectives, it uses petitions, legal complaints, and corporate records to understand how knowledge of seasonal and geological processes shaped the historical transformation of the river. With all of these sources, this dissertation uncovers patterns of local knowledge about water use and explores their deployment in the politics of industrialization and urbanization.

Ideas about water in the nineteenth-century Connecticut River Valley reveal the practices and politics of water use alongside how it shaped people's lives in practical ways. Their efforts at stewarding human entanglements with the landscape emerged from a perspective that envisioned a popular alternative to river engineering. Attending to how encounters with the landscape shaped perspectives on temporality provides a means of understanding how valley residents understood their river and its floodplain. In addition to its role in forming an environmental politics that shaped industrialization, treating public perspectives on rivers as engines of temporality provides a means of critically assessing key concepts in river history including watersheds, flooding, and the commodification of water.

Acknowledgments:

I cannot help being awed and humbled by the amount of support that I have received from old friends, colleagues, mentors and even open-hearted strangers throughout graduate school in the completion of this dissertation. I would not have imagined attending graduate school without the support of professors who encouraged my curiosity during my undergraduate years. I could not have completed my research or kept with my writing without the team of friends and family members who opened up their houses, shared meals, and facilitated transportation during my research trips. I could not have completed coursework and writing without the advocacy, support, and criticism of faculty and colleagues in the University of Kansas Department of History, the Department of Environmental Studies, and the interdisciplinary community that facilitates environmental research across the university.

Karl Brooks welcomed me into the Department of History and professors Paul Kelton, Kim Warren, and Jeffrey Moran provided a background in United States history. Donald Worster, Sara Gregg, and Gregory Cushman introduced me to the principles and practices of environmental history in a series of seminars and colloquia. Within this coursework, I befriended an array of colleagues whose critique and friendship made graduate school possible. Josh Nygren, Melinda Landeck, Shay Wood, Adam Sundberg, Amanda Schlumpberger, and Harley Davidson encouraged the completion of my first draft in a dynamic writing group. Brian Rumsey, Brandon Luedtke, and Alex Boynton also provided valuable feedback on chapter drafts. Laura Dean and Allison Schmidt shared coffee and commiseration in writing and editing.

The University of Kansas provided me with a generous University Graduate Fellowship, the Doctoral Student Research Fund, and teaching assistantships that made it possible to complete my studies and develop my dissertation. Outside the university, funding from the CUNY Crossroads in Environmental Science and Technology Program and Andrew W. Mellon Fellowship at the Massachusetts Historical Society supported the development of the ideas in this project. Particular thanks are due to Peter Drummey, Kate Viens, and Conrad Wright at the Massachusetts Historical Society and Charles Vorosmarty, Caroline Hermans, and Brian Voight at CUNY.

Studying a river valley far removed from my home on the Kaw necessitated, and undoubtedly tried, the patience of more than enough friends to field a soccer team. Bart Everts shared an attic apartment in Hyde Park while I worked at the Massachusetts Historical Society in Boston, Pooja Kanwar and Rose Graves welcomed me to Vermont during a side trip connected with that effort. Val Hunt and Teresa Hohenstein welcomed me to Boston after I defended my proposal and set me on the road to research, Jonah Erikson lent me a car, which traversed the valley from the Canadian border to the Long Island Sound. Judy Williams welcomed me to her home in Hanover, New Hampshire and rekindled a friendship going back decades. Allison and Dustin Ray shared their home in Coventry, Connecticut and the rare charms of Hosmer Mountain Root Beer. My brother, David Taber and his partner Alana Kumbier provided more than a month of shared meals, engaging conversations, and the charming, but elusive presence of Radio the cat in Northampton, Massachusetts. My parents, Sarah Spencer and Shearman Taber, provided hospitality during research travel and grandparental childcare for my daughter during a research trip to Boston. While researching In Washington, D.C., Jeffrey Brideau provided a welcoming apartment. When traveling to conferences, hosts including Jessica Rae Musinski and Jim Straub welcomed me into their homes. I also spent a great deal of time during this project couch surfing in the guest rooms of strangers from Worcester, Massachusetts to Lyndonville, Vermont and from Brattleboro, Vermont to Toronto, Ontario. Thanks to Jeremy and Sherry Champlin, Geri Medina, Emily Buckley, and Jacob Larsen for your companionship while traveling for research and conference presentations. The opportunity to share my fascination with the history of your hometowns made the research process exciting and opened up new windows in my research.

In two research trips funded by a University of Kansas University Graduate Fellowship and the Doctoral Student Research Fund, I benefitted from assistance by archivists at the American Antiquarian Society, the Connecticut Historical Society, the Dodd Special Collections Library at the University of Connecticut, Memorial Libraries at Historic Deerfield, Brattleboro Free Library, University of Massachusetts Special Collections and University Archives, the Connecticut Historical Society, the Connecticut State Library, the Hartford History Collection at Hartford Public Library, Library of Congress Special Collections, the Holyoke Public Library Holyoke History Room, the Massachusetts State Archives, Dartmouth College Rauner Special Collections Library, and town meeting records held by Town Halls in Hadley and West Springfield. Archivists and Town Clerks across New England and up and down the East Coast worked patiently to fill innumerable call slips and guided me to new sources. Closer to home, this dissertation relies on sources from five of the six libraries at the University of Kansas, not to mention an array of books, theses, and articles acquired through interlibrary loan. Additionally, the library provided a space to write and think away from the bustle of the classroom.

This dissertation grew out of a series of tough questions about how people lived and worked with water. While these initial queries seemed like casual questions, they grew into a dissertation that I did not anticipate when entering graduate school. When Don Worster asked

what came before the levees and dams that defined twentieth century flood control efforts, I responded by directing my attention to the unfamiliarity of water use practices in the early nineteenth-century Connecticut Valley. Several years later, Ed Russell suggested that my work concerned continuities in water use rather than change, prompting a busy season of contemplation about how historian periodize continuity and change when describing the passage of time. In working to answer these broad questions, I took my research in directions that often seemed surprising to Ed and Don, but they remained unflagging in their efforts at finding the direction and possibilities in my work.

Writing a dissertation may be a marathon rather than a sprint, but the advising process for this project has been a relay race. In my third year, Greg Cushman stepped in as my advisor, providing guidance and challenging questions during my Master's exam and in the formulation of my dissertation prospectus. Greg worked to expand my horizons, pushing me to reconceptualize river history as the study of water throughout the landscape rather than a more narrowly channelized forms of rivers. This contributed to the growing scope of research and accounts for much of the variety in my source base and chapters. Greg Cushman advised this project and oversaw its development in its proposal and initial research, taking the initial germ of a research from the research paper that became chapter six and encouraging its expansion from a river history into a study of how people live and work with water. Greg's expansive sense of what environmental history can be and the significance of its guiding questions to the discipline and the world at large shaped this work in significant ways.

Sara Gregg carried the baton with Greg during the middle portion of the research and writing process. Her experience in studying the politics of land use in the nineteenth and twentieth centuries provided a critical base for analyzing key research questions that emerged within the writing process. She worked with me as a second round of research travel upended many of the assumptions that had guided my initial drafting process and helped the dissertation to acquire its present form. By providing space to write and key critical feedback, Sara helped me find the narrative voice and methodological approach to studying the history of water that ultimately gave this dissertation its shape. In this process, Sara took the baton as advisor during this process and saw it through to the defense with keen organizational acumen and critical judgment.

Finally, this work would not exist without the contributions of my partner, Ciara Xyerra and our daughter Ramona Xyerra-Taber. Ramona's birth, coming just ten days after I completed my first research trip, transformed my life. My dissertation grew into a finished manuscript alongside her. During the first three years of her life, she learned to walk as I completed my first draft, learned to talk as I found my voice as a historian, and learned to count as I mused on the question of what counted in my writing. It has been one of the true joys of the dissertation writing process to grow alongside her. Finally, Ciara Xyerra has been at the foundation of my life for the last nine years. We built a life together in Somerville and she moved to Kansas with me. She showed considerable patience throughout research trips, late nights of writing and grading, struggles in preparing for exams, and deep dives into historical research. This work is dedicated to Ciara and Ramona, whose support made it possible.

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Introduction: Understanding Time on the Preindustrial Floodplain

In 1821, Joseph Lyman—a boatman from Northampton—petitioned to cut a new channel for the Connecticut River through the narrow neck of Hockanum Peninsula in the neighboring town of Hadley. This channel would eliminate a meandering bend in the river where it followed "a circuit (to the West) of near four miles through a tract of fine interval land without making direct progress of more than forty rods"[1] or about six-hundred-and-sixty feet. Lyman and his fellow boatmen complained that the river's broad turn exposed boats to winds from all directions while the slow currents rounding the bend allowed the river to deposit tons of silt in an ever-changing array of shoals. Moreover, his neighbors in Northampton stood to gain four hundred and thirty acres of land by the redirection of the river, while sacrificing only a thin sliver of about fifty acres from the neck of the peninsula. Lyman's vision of river engineering put his community and his neighbors squarely in control over the shape of the landscape.

The residents of Hadley, the town across the river from Northampton where the Hockanum Peninsula actually sat, disagreed with Lyman. The farmers who worked the Hockanum meadows protested that this would transform their land into an island and leave it isolated while the old channel remained swamped in an oxbow lake. They argued against Lyman's vision of how the floodplain landscape ought to be managed. Rather than encouraging human action to direct the process of erosion, they maintained that human action ought to adapt to and accommodate these erosive processes. They treated this as a moral issues, where "by the alterations which from time to time have taken place in the course of Connecticut River,

1 "Petition of Joseph Lyman and Others to Change the Bed of the Connecticut River" Massachusetts State Senate Bill 6670, Doc. 1, 1821, Unpassed Legislation, Massachusetts State Archives (MSA), Boston.

Northampton has gained as much land from Hadley as Hadley has from Northampton"[2] and that these exchanges ought to continue being driven by the river's flow, rather than the potentially destructive interference of local landowners. Their argument envisioned the geological processes inherent in the erosion of the riverbanks as a neutral arbiter of how land ought to be distributed along the floodplain. The State Senate agreed with the Hadley farmers and the bill died in committee. Nevertheless the story of this proposal to redirect the river was representative of a broader debate over river engineering and the social meaning of water in the Connecticut River Valley during the Early American Republic. Communities pitted rival accounts of the river's geology and its potential changes during seasonal variations against one another as part of an emergent politics of water management. These politics, in turn, revealed how communities understood the flow of water in time.

Residents of the Connecticut River Valley understood the flow of water as a product of intersecting timescales that shaped their everyday lives. They debated whether or not river engineering practices such as the excavation of new channels, the construction of levees, or even the building of bridges would reshape the river for the better. Communities analyzed structures such as transportation canals, water-supply systems, industrial water power, and agricultural land drainage by reference to variations in the flow of water on seasonal, historical, and geological timescales. They invoked the risk of spring floods overwhelming engineering efforts. They stood by their historical rights as communities and riparian proprietors. They even invoked millennia of geomorphological change over which the river had carved new channels into the floodplain.[3]

2 "Remonstrance to Petition Written by Northampton Resident Joseph Lyman" Sen. 6670 Doc. 2, 1821, MSA.

3 Valley residents did not actively work to reconcile the geological timeline with the biblical timeline. See Ronald L. Numbers "Science and Religion." *Osiris* 1 (January 1, 1985): 59–80.

These intersecting timescales provided a common frame of reference for understanding and working with a river without engineering its flow. This understanding guided their engagement in water politics during the Early Republic. As a result of the social and political power wielded on behalf of the river's existing flows, the farms, factories, canals, and cities that reshaped the Connecticut Valley landscape molded themselves to the spaces opened up in the interstices of everyday water use.

This dissertation asks how residents of the Connecticut River Valley understood the flow of water and used it as a tool to facilitate agriculture, transportation and manufacturing between 1790 and 1870. This period saw a dramatic transformation in the use of water as industrialization, transportation improvements, and urbanization reshaped the landscape, but they did not create a wholly new landscape. Instead, the farmers whose land use dominated the floodplain advocated for the preservation of their sense of temporality—a rhythm of everyday life—and these protests guided processes of industrialization and urbanization that transformed the floodplain. Over time, innovations in water use—such as transportation canals, bridges, water power dams, factories, and levees—were built on an existing base of land uses were characteristic of, and perhaps singular to, the Connecticut Valley.[4] A sense of geological, seasonal, and historical time guided land use in the Connecticut Valley and this information situated property—both common and private—in society and on the landscape. In proposing to redirect the river, Lyman envisioned a radical reworking of property ownership patterns that dominated the landscape. His was one of dozens of engineering projects put forward in the

4 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): 111–34; Star, "The Ethnography of Infrastructure," *American Behavioral Scientist* 43, no. 3 (November, 1999): 377–91.

course of remaking the Connecticut as an industrial river.[5] People interested in fostering improvements to transportation, agriculture, or manufacturing ignored this preexisting sense of time at their own peril. Nevertheless, many of the people proposing the engineering of the river's flow described the valley as a blank slate unencumbered by infrastructure. In this, they courted conflict by ignoring the existing network of land and water use practices in the region. This tension between development proposals envisioning a blank canvas and the dense network of existing land uses throughout the region sat at the heart of debates over water use in the early nineteenth century.

The builders of water use infrastructure in the Connecticut Valley during the nineteenth century did not imagine a singular watershed whose flows might be evened out with dams and levees.[6] Instead, communities lived with a river that varied seasonally and shifted slowly across the floodplain in ongoing patterns of erosion and deposition. They understood these flows as an element of the landscape whose variations were understood in terms of how they shaped individual reaches of the river.[7] The form of knowledge about natural systems rested in seasonal conditions along individual reaches of the river. Communities living along the Connecticut

5 *Water Power in the United States* Tenth U.S. Census v. 16 (Washington D.C.: Government Printing Office, 1880) provides the most comprehensive description of the range of water power development.

6 Ashley Carse, *Beyond the Big Ditch: Politics, Ecology, and Infrastructure at the Panama Canal* (Cambridge: MIT Press, 2014); Jamie Linton, *What Is Water?: The History of a Modern Abstraction* (Vancouver: UBC Press, 2010).

7 The use of element here is deliberate. Conevery Bolton Valenčius, *The Health of the Country: How American Settlers Understood Themselves and Their Land* (New York: Basic Books, 2002). Jeffrey Jerome Cohen and Lowell Duckert, eds., *Elemental Ecocriticism: Thinking with Earth, Air, Water, and Fire* (Minneapolis: University of Minnesota Press, 2015); John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago: The University of Chicago Press, 2015).

between 1790 and 1870 generally thought about water as an element whose flows recurred historically within their neighborhoods rather than as a natural system interconnecting spaces within the watershed at large. Local knowledge of the river grew out of an awareness of how water flowed across particular properties and places, not from an awareness of the mechanics of the river basin as a whole, which meant that residents of the valley paid particular attention to the movement of water through their home communities. They integrated these local flows into their everyday lives and this contributed to their engagement with questions about geological changes and the role of weather in shaping local flows in specific places within the watershed.

In keeping with historical understandings of the Connecticut in discrete reaches, my research focuses on only a portion of the river's 12,000 square mile drainage area. It covers what might be called the middle valley, ranging northward from Hartford to the river's confluence with the Deerfield, and fanning out into the tributaries to study the development of industrial water power. This geography reflects the valley's geology. It begins just north of the moraine that drained Glacial Lake Hitchcock, a remnant of New England's coverage by the Laurentide Ice Sheet, which retreated approximately 13,500 years ago. This ancient lakebed—an object of conversation in local geology even before the discovery of glaciation—bestowed common features upon the landscape between Hartford and Deerfield. Situated between the ridges of the Middletown, Metacomet, and Holyoke ranges, the glacial lake deposited deep layers of sediments in what became the river's floodplain. It did not, however distribute these soils evenly. The glacier's terminal moraines created a series of dams that drained in successive floods moving from south to north, leaving a series of terraces consisting of relatively smooth, rock-free soil that provided excellent farmland. The river cut a changing course across these flood-prone terraces, and these geomorphological changes stand at the heart of my analysis of the floodplain. It was in this geological landscape that residents of the Connecticut Valley learned to live with water as a force shaping the landscape.[8]

While industrialization adapted to existing land uses, it also multiplied the number of small water users, a process that transformed perspectives on what might be possible on a given landscape. Increasing densities of water use reflected more than changes in the intensity of land and water use on the floodplain, they also reflected changes in how communities thought about water. Industrialization did not just mean demands for larger dams, deeper channels, and expansions of arable land, it also meant changes in how people contextualized temporality and the flow of water. This dissertation examines these changes in three sections. The first section looks at the continuities underlying local perspectives on water use between 1790 and 1870. It examines how communities in the Connecticut River Valley used climate, geology, and historical memory as frames of reference for describing the character of the river and its tributaries. The second section asks how local accounts of the river shaped transportation improvements and industrial processes within the valley. The third section explores how forms of industrial development that took an active role in reshaping the landscape fit themselves into the valley given the continuing force of local ways of seeing the river. The river itself still accommodated

8 Carl Koteff and Fred Pessl, "Systematic Ice Retreat in New England" (United States Geological Survey, 1981), http://pubs.er.usgs.gov/publication/pp1179; John C. Ridge, "The Quaternary Glaciation of Western New England with Correlations to Surrounding Areas," in *Developments in Quaternary Sciences*, ed. J. Ehlers and P.L. Gibbard, vol. Volume 2, Part B (Elsevier, 2004), 169–99, http://www.sciencedirect.com/science/article/pii/S1571086604801969; Grahame J. Larson and Byron D. Stone, eds., *Late Wisconsinan Glaciation of New England: A Proceeding Volume of the Symposium, Late Wisconsinan Glaciation of New England, Held at Philadelphia, Pennsylvania, March 13, 1980* (Dubuque, Iowa: Kendall/Hunt Pub. Co, 1982).

many of the same local ways of knowing its flow throughout the period of study, but the overweening political power that came with this knowledge waned as the nineteenth century wore on.

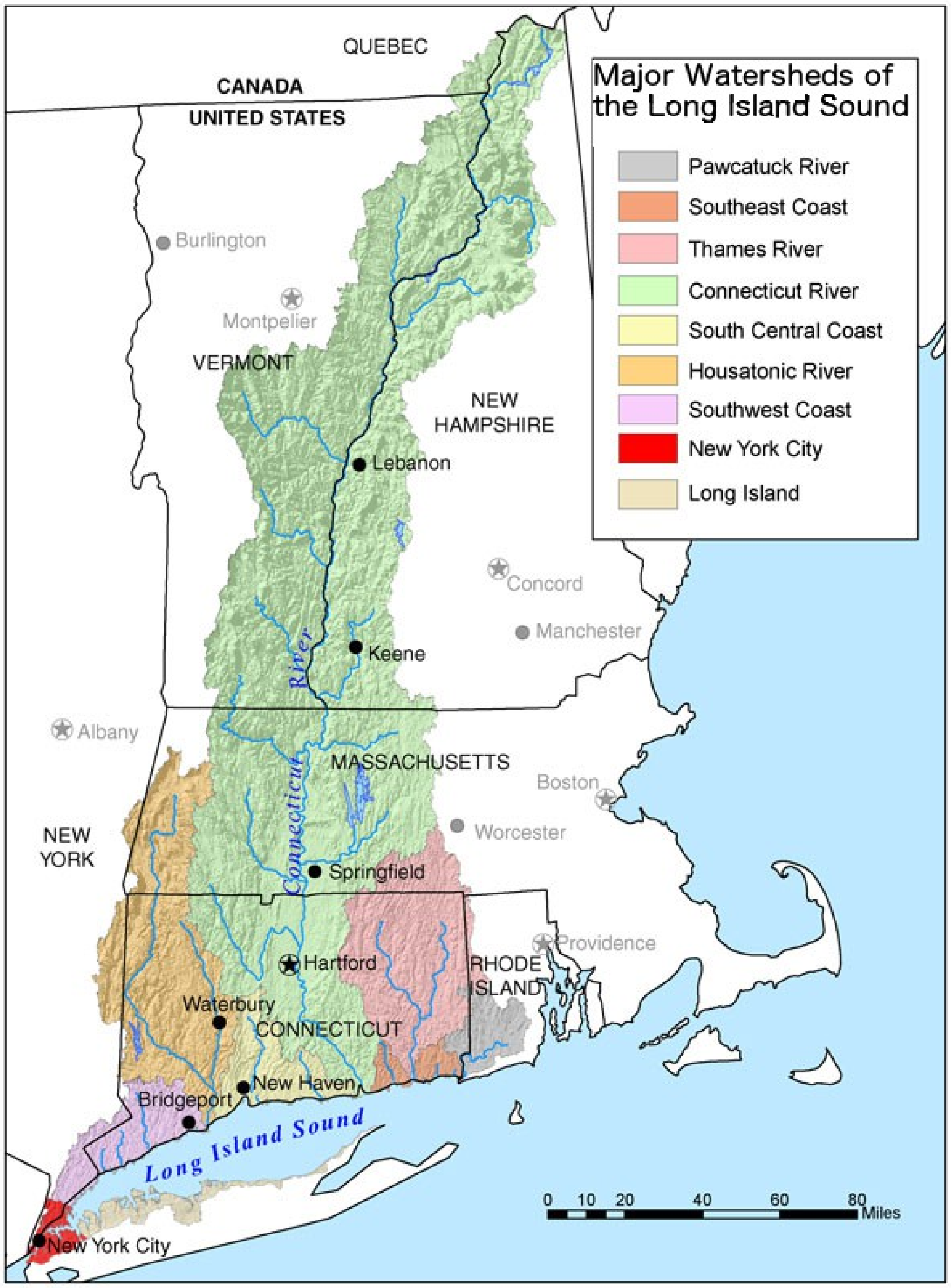

Figure 1: Watersheds draining into the Long Island Sound, Connecticut River Watershed Atlas, USGS, http://nh.water.usgs.gov/project/ct_atlas/index.htm

As farmers worked the floodplain meadows during the early nineteenth century they recognized how unique the low lying terraces of the river's floodplain were as an element of the New England landscape. In the uplands surrounding the river—the Worcester Highlands and the Berkshire Mountains—rivers cut relatively swift courses through rocky soil, but down on the valley floor of the Connecticut, broad stretches of relatively flat land showed only the relief left by ancient river channels, long abandoned by the meandering stream. Farmers understood the landscape as a place changed over millennia by ancient lakes that had deposited sediments at the base of the Connecticut River's floodplain terraces, just as the slow flow of water around the Hockanum bend left shoals in the river channel. While they did not understand the agency behind this lake formation—attributing it to historical deluges rather than continental glaciation—they understood that the valley's deep history differed dramatically from its present. Perhaps more importantly for this dissertation, they insisted repeatedly that this history should shape the future of the river's flow.

Seasonal flows of water, particularly dramatic flooding associated with the spring thaw, played a key role in shaping the landscape from year to year. Indeed, valley residents attributed many of the geological changes visible within the valley to seasonal variations in the river's flow. The spring thaws carried debris and ice downstream, often creating ice jams that spilled the river over its banks and onto the adjoining fields, depositing fine layers of silt that enriched the soil while also intensifying the process of erosion that wrought ongoing geological changes. Seasonal and geological accounts of the river's flow shared a common focus on the discontinuities and extremes—the peaks and valleys in the flow of water across the landscape—

as processes that shaped the river's course. It was in these extremes that large-scale changes to the valley's landscape occurred.

Debates over river engineering incorporated local knowledge of flows in seasonal and geological time while also reflecting human interaction in the flow of water over historical time–and identifying and interpreting these forms of knowledge permits a new vantage point on the use of historical memory in local decision-making. Communities would have nothing meaningful to say about the flow of water without some historical knowledge of how river had flowed and recollections of the previous human interventions that shaped its flow. Beyond this basic level, communities protesting against the reshaping of the river often distinguished between rights to engineer the river gained through experience in working with water and the new privileges in water use being arrogated in efforts at river engineering. The key questions in these disputes concern which specific elements of river engineering connected with specific landscapes upon which they operated. This marks something of a departure from the study of historical memory in its more familiar form as an object of collective cultural identity building.[9] Instead of adhering to iconic landmarks, the historical memories embedded in the waterscape of the Connecticut River Valley consisted of everything from drainage ditches and fence lines to dam sites and high water marks. These provided indicators of who could do what with given pieces of land. This

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9 Peter Burke, "History as Social Memory," in *Memory: History, Culture and the Mind*, ed. Thomas Butler, Wolfson College Lectures (New York: B. Blackwell, 1989); Maurice Halbwachs, *The Collective Memory* (New York: Harper & Row, 1980); Pierre Nora, "Between Memory and History: Les Lieux de Mémoire," *Representations*, no. 26 (April 1989): 7–24; Simon Schama, *Landscape and Memory*, (New York: Knopf, 1995); Richard Terdiman, *Present Past: Modernity and the Memory Crisis* (Ithaca: Cornell University Press, 1993); John C. Walsh and James W. Opp, *Placing Memory and Remembering Place in Canada* (Vancouver: UBC Press, 2010); Michael Kempe, "'Mind the Next Flood!' Memories of Natural Disasters in Northern Germany from the Sixteenth Century to the Present," *The Medieval History Journal* 10, no. 1–2 (October 2007): 327–54.

type of historical memory proved important in setting the meaning and defining the uses of water in the Connecticut River Valley not only because it set a boundary between what had historically been acceptable or unacceptable, but also because it set boundaries separating acceptable and unacceptable forms of interventions on the landscape.[10]

Local Knowledge and River History

The history of the Connecticut River Valley has long been overshadowed by neighboring river valleys. It also reclaims the place of the river in shaping the development of the valley, as historians have tended to treat its agricultural production in the nineteenth century as little more than a succession of commodities displaced by western producers as cattle, wheat, sheep and broom corn floated down the Erie Canal to Albany and New York City.[11] They examined the history of its industrialization as a process of reinvestment driven by surplus capital and already established knowledge of water power.[12] Even its most famous piece of artwork, Thomas Cole's *View From Mount Holyoke, Northampton, After a Thunderstorm*, better known as *The Oxbow*, has become an emblem of the Hudson River School of Romantic landscape art and is only

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10 Carol Rose *Property and Persuasion* (Boulder: Westview, 1994) argues that property law creates a common repository for creating and recording property rights.

11 Carol Sheriff, *The Artificial River: The Erie Canal and the Paradox of Progress, 1817-1862* (New York: Hill and Wang, 1996); Howard S. Russell, *A Long, Deep Furrow: Three Centuries of Farming in New England* (Hanover, N.H: University Press of New England, 1976); Margaret Richards Pabst, *Agricultural Trends in the Connecticut Valley Region of Massachusetts, 1800-1900*, Smith College Studies in History, v. 26, (Northampton: Smith College, 1941.

12 Vera Shlakman, *Economic History of a Factory Town: a Study of Chicopee, Massachusetts*, Smith College Studies in History, v. 20 (Northampton: Smith College, 1935) described the capital supporting Connecticut Valley industrialization as a product of the Boston Associates; Francois Weil, “Capitalism and Industrialization in New England, 1815-1845,” *The Journal of American History* 84, no. 4 (March 1998): 1334–54 criticizes this approach and refines it; to see its survival in environmental history see Richard William Judd, *Second Nature: An Environmental History of New England* (Amherst: University of Massachusetts Press, 2014).

peripherally associated with the valley in which it was painted.[13] Why do we find this convergence of historiographical narratives grounded in the Connecticut Valley's inability to control its own destiny? Why is the history of the Connecticut Valley so often defined by neighboring valleys?

By contrast, residents of the Connecticut River Valley in the early nineteenth century did not see history as something that happened to them, they saw history as a process that they helped to shape. To understand how they acted to shape it, however, we need to reconstruct how they situated themselves and their landscapes in time. This work refocuses the historiographies of New England, as well as of rivers and temporality by examining valley communities as active agents shaping the landscape changes driven by surrounding industrialization and urbanization. The process of reconstructing what it meant to "think like a floodplain" entails a departure from established perspectives in New England history, river history, and the history of time. It explores how the Connecticut River and its valley played a crucial role in mediating relationships with the landscape. This departs from New England's environmental history—often studied as a history of the exportable commodities that defined the region's economy and their role in shaping industrialization and commodification. It also represents a departure from river history—often studied primarily as a history of the modernization and management of water. Because communities in the valley understood their rivers as integral elements of landscapes that changed in timescales dictated by natural history and human history, they read the flow of water as a temporal force. Reframing the analysis of time as an element of landscape analysis departs from established conventions of the history of temporality as an element of industrialization.

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13 Barbara Novak, *Nature and Culture: American Landscape and Painting, 1825-1875* (New York, NY: Oxford University Press, 2007).

The historiography of the Connecticut River Valley suffers from an inferiority complex because the region's historians professionalized just as the region deindustrialized. The tradition of talented amateur historiography that defined the nineteenth century gave way to professional and critical approaches to writing its history in the 1930s. This was not entirely unlucky because a young Merle Curti, supervising Masters degree candidates at Smith College, helped his students develop a string of works studying the valley's economic development. They documented town government, agricultural change, industrialization, railroad building, and trust formation, outlining many important elements of the valley's history.[14] At the same time, they took up these studies at a time when it was easiest to recognize the evils of the industrial city, the abandoned tracks left behind by the railroad, and the continuing economic pressure of rival farming districts exerted on the Connecticut Valley economy. Indeed, the professionalization of historical studies focused on the valley coincided with a broader concern for researching New England's decline within a framework dominated by a narrative describing a mature economy felled by younger and more dynamic places of growth.[15] The Connecticut Valley did not appear

14 Grace Pierpont Fuller, *An Introduction to the History of Connecticut as a Manufacturing State*, Smith College Studies in History, v. 1, no. 1 (Northampton: Smith College, 1915); Thelma Maddie Kistler, *The Rise of Railroads in the Connecticut River Valley*, Smith College Studies in History, v. 23 (Northampton, Mass: Smith college, 1938); Katharine Du Pre Lumpkin, *Shutdowns in the Connecticut Valley: A Study of Worker Displacement in the Small Industrial Community*, Smith College Studies in History, v. 19, no. 3-4 (Northampton: Smith College, 1934); Margaret Elizabeth Martin, *Merchants and Trade of the Connecticut River Valley, 1750-1820*, Smith College Studies in History, v. 24 (Northampton: Smith College, 1939); Margaret Richards Pabst, *Agricultural Trends in the Connecticut Valley*; Shlakman, *Economic History of a Factory Town*, Smith College Studies in History, v. 20 (Northampton: Smith College, 1935).

15 Lawrence Dame, *New England Comes Back* (New York: Random House, 1940); Seymour E. Harris, "New England's Decline in the American Economy," *Harvard Business Review* 25, no. 3 (Spring 1947): 348–71; Idem., *The Economics of New England; Case Study of an Older Area* (Cambridge: Harvard University Press, 1952); John D. Black, *The Rural Economy of New England, a Regional Study* (Cambridge: Harvard University Press, 1950); Southern competition for New England's industrial base is documented in Christopher J. Manganiello, *Southern Water,*

to drive its own history when this place became an area of focus during the 1930s. This approach to studying the valley fanned out beyond its origins in the idea of mature economies that dominated the study of New England in the mid-twentieth century to shape the historiography of the region going forward. Amidst this talk of declension, many scholars studied New England's town meetings as indicators of a resilient community life that helped them negotiate their economic woes.[16]

This declensionist perspective lived on in accounts of New England's environmental history featuring how vibrant local politics contributed to community-based ideas of conservation such as Richard Judd's *Common Lands, Common People* and John Cumbler's *Reasonable Use*.[17] These books explored the role of farmers and fishermen in New England in the development of the conservation movement as they sought to shepherd their small farms and towns through the appropriation of common fisheries and the deforestation of uplands. These two works effectively draw forward the view of natural resources outlined in Jeffrey Vickers' *Farmers and Fishermen* to explain how the desire for a competence defined visions of work and land use in the mentalities of rural New Englanders during the Early Republic.[18] Each of these works shares what I call a resource paradigm. When Cumbler speaks about rivers, he turns to the

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Southern Power: How the Politics of Cheap Energy and Water Scarcity Shaped a Region (Chapel Hill: The University of North Carolina Press, 2015).

16 John Gould, *New England Town Meeting: Safeguard of Democracy* (Brattleboro, VT: Stephen Day Press, 1940).

17 Richard William Judd, *Common Lands, Common People: The Origins of Conservation in Northern New England* (Cambridge, Mass: Harvard University Press, 1997); John Cumbler, *Reasonable Use: The People, the Environment, and the State, New England, 1790-1930* (Oxford: Oxford University Press, 2001).

18 Daniel Vickers, *Farmers & Fishermen: Two Centuries of Work in Essex County, Massachusetts, 1630-1850* (Chapel Hill: University of North Carolina Press, 1994).

fish. When speaking of the land, Judd turns to forests. Natural resources and their conservation sit at the heart of his account of stewardship and the work underlying continuity in land use in northern New England. This framework provides a powerful means of understanding the elements of the landscape that New Englanders commodified during the settlement and early history of New England. Fisheries, forests and soil produced market commodities—lumber, fish, and corn—from a seemingly vast store that was nevertheless exhaustible. Many people worried that the fisheries in the Connecticut might fail; nobody worried that the Connecticut would run out of water. Analogously, communities worried about preserving forests and soil, particularly in the uplands, but floodplains did not fit into the resource paradigm.

The floodplain landscapes of the Connecticut River Valley provided a locale for work in a temporally bound context. Temporality, in this work, refers to the relationships that Connecticut Valley residents identified between the seasonal, historical, and geological timescales over which water shaped the landscape. Rather than pitting one method of exploiting rivers—fishing—against another method—water power—this dissertation investigates how and why people expressed concern for the integrity of floodplain landscapes. Their protests against river engineering projects sought to protect a way of knowing the landscape holistically rather than any particular element of the landscape. They shared an interest in continuity, but rather than being concerned with marketable resources, they were concerned with the landscape, the seasons, and historically grounded relationships with the use of water. Thinking like a floodplain captured more than just an interest in developing a state apparatus for ensuring the continued and growing economic activity associated with resources. It also entailed a politics of land management that ensured the continuity of the flow of water that would ensure community survival. This concern for survival, stability, and continuity is noteworthy, even if the lives of Connecticut Valley residents remained notably absent in the headline narratives of social progress, and its consequences, that characterized the development of neighboring valleys.

Water use in the nineteenth century Connecticut Valley existed in counterpoint with its neighbor, the Merrimack Valley. Theodore Steinberg's *Nature Incorporated* provides an account of how capitalists from Boston acquired rights to dam the Merrimack River at what is now Lowell, Massachusetts in 1821 and used their legal and political leverage in tandem with some clever engineering to measure and regulate the flow of water through their canals and turbines. These single minded investors came to dominate the Merrimack, but the Connecticut remained fragmented among small mill owners. The owners of water-powered textile mills in Lowell consolidated many of the water rights upriver and constructed dams in an effort to even out the flow of water in the river from its source to the factory wheels. Connecticut Valley factories did not attempt this centralization until the 1860s and even then, their efforts focused on tributary streams.[19] This dissertation documents how water power and capital along the Connecticut remained diffuse, and this decentralization had consequences for how water flowed and how people understood its flow. The conditions surrounding the ownership, management, and growth of industry differed substantially between the Connecticut and Merrimack. It stands to reason, therefore, that the priorities and processes underlying the growth of river management also contrasted. People who use water differently in different institutional settings will likely have contrasting perspectives on the character of its flow. Thus, we can say that water became commodified in the development of Lowell, but it remained an element of the underlying

19 Robert B. Gordon, "Hydrological Science and the Development of Waterpower for Manufacturing," *Technology and Culture* 26, no. 2 (1985): 204–35, doi:10.2307/3104341.

property in the development of factories along the Connecticut. This prevented industrial development from running roughshod over the property rights of upstream water users in the Connecticut, as they had in the Merrimack. This is not to say that water was never measured and commodified in the Connecticut Valley, but rather to say that the experience of its commodification differed. Indeed, it may be helpful to imagine commodification and water markets as a continuum between centralized rivers that account for every cubic foot of water and decentralized rivers where water measurement remains rudimentary.[20]

The Connecticut Valley did not open a new frontier in riverine landscapes on par with the textile mills at Lowell or the Erie Canal, but this lack of a central authority exercising overweening power left room for everyday life to exercise a historical force of its own. A wealth of sources from the valley speak to the everyday life of local communities.[21] Account books and diaries from residents provide an essential source for understanding the transition to capitalism in New England. Where these sources also include weather records, and many of them do, they provide an important window into how the landscape shaped ordinary people's water use. Complementing this body of sources, descriptive accounts of the landscape ranging from

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20 Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Cambridge: Cambridge University Press, 1991); Edwin T. Layton, "Scientific Technology, 1845-1900: The Hydraulic Turbine and the Origins of American Industrial Research," *Technology and Culture* 20, no. 1 (1979): 64–89, doi:10.2307/3103112.

21 Christopher Clark, *The Roots of Rural Capitalism: Western Massachusetts, 1780-1860* (Ithaca: Cornell University Press, 1990); and Winifred Barr Rothenberg, *From Market-Places to a Market Economy: The Transformation of Rural Massachusetts, 1750-1850* (Chicago: University of Chicago Press, 1992) document the transition to capitalism in everyday life; Examples of the valley's cultivation of everyday life as a field of historical preservation and self-representation include Robert Paynter, "Time in the Valley: Narratives about Rural New England," *Current Anthropology* 43, no. S4 (August, 2002): S85–101; and Michael C. Batinski, *Pastkeepers in a Small Place: Five Centuries in Deerfield, Massachusetts* (Amherst: University of Massachusetts Press, 2004).

Timothy Dwight's *Travels in New England and New York* to anonymous investigations of proposed changes to the river channel document how ordinary people informed elite accounts of the riverine landscape. These sources focused on the concerns and questions of elites, but they depended on information provided by ordinary people, and it is possible to dig into their characterizations of the landscape to find suggestive indications of how ordinary people thought about the flow of water.[22] Similarly, studying court cases in order to examine the forms of evidence that they mobilize rather than their outcomes, or studying a geographical account of the valley for the types of evidence of landscape change that it describes rather than probing directly into the impacts of human presence on the landscape provides a means of historicizing the nineteenth-century use of the landscape.

These quotidian sources document politically vibrant communities across the valley that played an active role in shaping efforts at river engineering. Popular participation in river management sprang from a sense of time grounded in ongoing geological processes. Nature's role was defined by evidence of its impact in shaping the landscape on a timescale that stretched beyond all human memory and provided confidence in the flow of water shaping seasonal cycles upon the landscape. These processes provided a basis for what Benjamin Cohen called 'homespun geology,' which is understood as the process of making observations about soil and landscape as part of everyday life during the early nineteenth century.[23] It is well accepted among historians of science that ordinary people taught physical geographers how to read the landscape,

22 For this approach, my work owes a debt to Richard Judd, *Common Lands, Common People The Origins of Conservation in Northern New England* (Cambridge, Mass: Harvard University Press, 1997).

23 Benjamin Cohen, *Notes From the Ground: Soil, Science, and Society in the American Countryside* (New Haven: Yale University Press, 2009)

but there is no consensus as to the significance of these insights.[24] Earth Science historian Martin J. S. Rudwick argues that ordinary people developed no significant scientific insight into geology, suggesting instead that they observed the landscape without having any independent insight into geological processes.[25] By contrast, Adrienne Mayor argues that ordinary people ranging from ancient Greece to indigenous communities in the southwestern United States produced an array of scientific observations that proved significant even if they did not conform to the canons of western scientific practice. Folkloric paleontology and the study of vernacular understandings of nineteenth-century river systems share a common vantage point because they raise similar questions about how ordinary people understood the larger geological, and ecological processes in their midst. Further, each asks how geological processes shaped people's lives, rather than what intellectual legacies they might have left.

This dissertation adapts a modified version of Mayor's accounting of the science underlying folkloric paleontology to explore the similarities between how local farmers and geographers described the riverine geology of the Connecticut Valley. It asks how farmers and artisans in the Connecticut River Valley interpreted the landscape according to three standards.[26] First, could they recognize parallels between contemporary changes in river channels and historical changes whose only remaining evidence came from memory or the landscape. Second, could they apply these understandings in political debates over how to shape and reshape the

24 Albert Carozzi's preface to Louis Agassiz, *Studies on Glaciers; Preceded by the Discourse of Neufchâtel* (New York: Hafner Publishing, 1967) outlines the casual incorporation of peasant knowledge into Charpentier's account of glacial drift.

25 M. J. S. Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* (Chicago: University of Chicago Press, 2005); Adrienne Mayor, *Fossil Legends of the First Americans* (Princeton, N.J: Princeton University Press, 2005).

26 Adrienne Mayor, *Fossil Legends of the First Americans* p. xviii.

river? Third, did their political power play any role in shaping industrialization or river engineering over the long run? According to this standard, geological knowledge among the Connecticut Valley farmers was influential insofar as they mobilized it to argue—as Lyman's critics did in protesting the modification of the channel at Hockanum—that the river's status as an agent of geological change ought to shape policy. At the same time, this dissertation argues that the effectiveness of this way of understanding geology depended on its integration within a practical working relationship with the land.

The politics of water use provided a key forum for the articulation of vernacular perspectives on geology. Mukerji's comment that local knowledge of the landscape in seventeenth-century France had "many uses but no authority" illustrated nicely the limitations of the cliché that knowledge equals power.[27] At the same time, it also pointed to a key difference between the experience of a peasant in seventeenth century France and residents of the Connecticut Valley in the Early American Republic. The latter communities found themselves in possession of both knowledge of the landscape and some measure of authority over its use. Part of that authority stemmed from the uncertainties that accompanied the transition to democracy in the United States.[28] Legislatures in the early nineteenth century chartered corporations that improved transportation and economic interconnectedness, but nobody imagined the forms of

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27 Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal Du Midi* (Princeton: Princeton University Press, 2009) p. 38.

28 Jack N. Rakove, "The Origins of Judicial Review: A Plea for New Contexts," *Stanford Law Review* 49, no. 5 (1997): 1031–64; Oscar Handlin and Mary Flug Handlin, *Commonwealth; a Study of the Role of Government in the American Economy: Massachusetts, 1774-1861* (Cambridge: Harvard University Press, 1969); Brian Balogh, *A Government Out of Sight: The Mystery of National Authority in Nineteenth-Century America* (Cambridge: Cambridge University Press, 2009); Morton J. Horwitz, *The Transformation of American Law, 1780-1860*, Studies in Legal History (Cambridge, Mass: Harvard University Press, 1977).

expertise and political compromise that would be necessary to carry out such improvements. This meant that problems arising from dams, bridges, levees, and new channels encouraged valley residents to explain how the river flowed under normal circumstances and how the engineered channel transformed that flow. When aggrieved citizens complained about the excesses of these corporations, there were no institutionalized legal or legislative channels to guide their protests against the transformation of the landscape.

The content of local protests reflected vernacular insights about the lay of the land that reframed the project of river engineering in temporal scales ranging from seasonal floods to centuries-old changes in the river channel. Petitioners justified their arguments by reference to the river's active work of shaping the landscape. By reconstructing these arguments and situating them in accounts of how residents of the valley lived their everyday lives, it becomes possible to historicize rivers like the Connecticut as active agents of landscape change.[29] Indeed, Joseph Lyman's petition to redirect the river through the Hockanum Peninsula envisioned cutting a shallow channel with a plow and allowing the flow of the river, sometimes described as its agency, to deepen and widen this course. This means of talking about nature's agency, wherein both sides tried to frame their arguments as forms of work attuned to the river's power, challenges easy assumptions about the assertion of control over nature during the course of nineteenth-century industrialization.[30]

29 David I. Spanagel, *DeWitt Clinton and Amos Eaton: Geology and Power in Early New York* (Baltimore: Johns Hopkins University Press, 2014); Andrew J. Lewis, *A Democracy of Facts: Natural History in the Early Republic* (Philadelphia: University of Pennsylvania Press, 2011).

30 Linda Nash, "The Agency of Nature or the Nature of Agency?," *Environmental History* 10, no. 1 (January 1, 2005): 67–69; Paul S. Sutter, "The World with Us: The State of American Environmental History," *Journal of American History* 100, no. 1 (June 1, 2013): 94–119.

Language focused on the river's agency and the frequent invocations of the river's power both in the moment of the spring flood and the gradual erosion of floodplain geology indicates how some threads in the growth of capitalism entailed working with nature while others entailed the presumption of control over nature. People in the Connecticut Valley entangled and re-entangled their lives with changing landscapes governed by the flow of water. This work builds on accounts of river history in the vein of Richard White's *Organic Machine* that describe how the act of intertwining community life with the river's flow shaped communities even as those communities thought they shaped the river. Building dams and canals, irrigating crops and lighting cities looks like the assertion of human control over the river, but it also signals the creation of human communities that depend on the river's power. This reciprocal relationship, White argued, freed the communities drawing water and power from the Columbia to operate on timescales independent of the river's flows. The turbines that power their lights and the canals that irrigate their crops operated autonomous of rainfall and seasonal change. At the same time, however, this temporality remains indebted to a historically unprecedented effort at engineering the landscape that remained contingent upon ongoing efforts at maintenance and negotiation. White recognized this when he described the twentieth-century communities created through the engineering of the Columbia River. Like many American communities, they were "impatient with history. But human actions on the Columbia have produced a long history, and history has consequences. Human history and the history of the river have merged to create the modern Columbia, which is at once a natural space and a social space."[31] By pulling back the curtain on the work that integrated the river's power into the fabric of everyday life in the Columbia Basin,

31 White, *Organic Machine* (New York: Hill and Wang, 1995) p. 112.

White illustrated how society seemed to be shaping the river in the short run, but over the long run the river's shaped society. The possibility of living on clock time in the Northwest depended on people's ability to reengineer the river so that its power arrived on schedule.

White described a river that had been rearranged to make modern water uses possible and concluded that the legacy of these processes necessitated the reassertion of history's importance. This last conclusion, that the transformation of temporality wrought by the engineering of the Columbia necessitated a reassertion of the historical processes, particularly the labor, underlying its transformation, might be an understated element of White's work. More so when compared with scholars focused especially on clock time such as E.P. Thompson, Michael O'Malley, and Nigel Thrift, who have given much more thought to how the rhythms of clockwork, the din of machinery, and the specificities of railroad timetables shaped industrializing societies.[32] White's challenge to presentism, and the idle fantasies that it breeds of undoing the decades of engineering that wrought the Columbia, fit within a broader sense that historical analysis loses something when people lose touch with the landscape.[33]

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32 E. P. Thompson, "Time, Work-Discipline, and Industrial Capitalism," *Past & Present*, no. 38 (December 1, 1967): 56–97; Paul Glennie and Nigel Thrift, "Reworking E. P. Thompson's 'Time, Work-Discipline and Industrial Capitalism,'" *Time & Society* 5, no. 3 (1996): 275–99; Jon May and Nigel Thrift, eds., *Timespace: Geographies of Temporality* (New York: Routledge, 2003); Michael Dunlop Young and Tom Schuller, eds., "Social Time Versus Natural Time," in *The Rhythms of Society* (London ; New York: Routledge, 1988), 198–226; Barbara Adam, *Time and Social Theory* (Philadelphia: Temple University Press, 1990); Michael O'Malley, *Keeping Watch: A History of American Time* (New York: Viking, 1990).

33 Richard White, *The Organic Machine*; similar works in this vein included Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (Seattle: University of Washington Press, 1999); Christopher Morris, *The Big Muddy: An Environmental History of the Mississippi and Its Peoples, from Hernando de Soto to Hurricane Katrina* (New York: Oxford University Press, 2012); Sara B. Pritchard, *Confluence: The Nature of Technology and the Remaking of the Rhône* (Cambridge: Harvard University Press, 2011); Manganiello, *Southern Water, Southern Power*.

Temporality promises to enrich our historical understanding of how people adapted preindustrial forms of timekeeping as industrialization proceded, but its relevance is also interdisciplinary. Tim Ingold argues that temporalities provide a bridge between archaeology and anthropology.[34] The project of the Long Term Ecological Research sites entails looking past what the ecologist John Magnuson calls the "invisible present." Magnuson argues, "in the absence of long-term research, serious misjudgments can occur not only in our attempts to understand and predict change in the world around us, but also in our attempts to manage our environment."[35] In the absence of scholarship detailing historical changes in timescale, historians can, and perhaps should, assume that their subjects were present minded. But this is not the only option.[36] Even if farmers in the Connecticut River Valley lack a comprehensive sense of the geological richness of deep time, historical timescales did clearly dominate their perspectives. This work contributes to the study of how people formed their own sense of temporality in everyday life during the nineteenth century and interrogates the question of how valley residents used their experiential knowledge of the landscape in their engagement with planning and politics. Scholars across disciplines share a common challenge in situating their work in timescales that have been divorced from day-to-day human experience. This challenge sets out a broader problem, familiar across disciplines in both natural and human history, about how learned understandings of

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34 Tim Ingold, "The Temporality of the Landscape," *World Archaeology* 25, no. 2 (October 1, 1993): 152–74.

35 John J. Magnuson, "Long-Term Ecological Research and the Invisible Present," *BioScience* 40, no. 7 (1990): 495–501.

36 Cinzia Cervato and Robert Frodeman, "The Significance of Geologic Time: Cultural, Educational, and Economic Frameworks" in Kim Kastens and Cathryn Manduca eds. *Earth and Mind II: A Synthesis of Research on Thinking and Learning in the Geosciences* (Boulder: Geological Society of America, 2012) p. 19-27.

temporality, instilled in classes on history, geology, or ecology ought to reshape people's understanding of time as an immanent feature of everyday life.

Attention to timekeeping grounded in seasonality provided a means for residents of the Connecticut Valley to understand landscape change independent of a broad spatial understanding of the Connecticut Valley watershed as a whole. Rather than thinking of the movement of water as a product of flows throughout the river valley, valley residents paid attention to the changes occurring on the landscape in time. Because they did not think holistically of the river as a watershed, they did not calculate the potential for water use in the landscape, but rather they had an ecologically coherent vision of water's flow absent the technologies and land use practices that enable thinking about the river as a watershed. Reconstructing this process as an element of the landscape history within the Connecticut Valley illustrates a key element of how people worked with water in this region.

Rivers and the Passage of Time Upon the Landscape

This work focuses on local perspectives on the river as illustrated in cases where competing water uses jostled against one another and no one element of the community emerged as a dominant figure. In this, the world of the Connecticut River Valley differed fundamentally from almost any other stream that has benefitted from treatment in a river history. In the absence of a central actor dominating the river's flow, our focus must necessarily shift to individual communities who shared the river with their upstream and downstream rivals. Rather than thinking of the river as a fully operational machine, individual communities saw the river as a tool that they appropriated as it flowed through their landscape and then subsequently shared with downstream landowners. At the same time, water did not amount to a simple resource separable from the landscape. Instead, users treated water as a substance inseparable from the landscapes upon which it flowed. This understanding of the river as a tool merges perspectives developed by the legal scholar Carol Rose, and the information theorists Susan Leigh Star, Geoffrey Bowker, Karen Ruhleder, and Yrjö Engestrom. Like a hammer, which can be used to drive nails, remove them, punch holes with an awl, or set grommets, rivets, and snaps depending on the context in which it is used, a river remains open to continual reappropriation and reuse throughout its course. Engestrom argued that "a tool is not just a thing with pre-given attributes frozen in time—but a thing [that] becomes a tool in practice for someone when connected to a particular activity."[37] For Engestrom, the question of when a person put a tool to use in the working process provided crucial details about how they used the tool and what they expected to gain from its use. This perspective, drawn from studies of the disconnect between the imagined uses of computer software and their actual applications in the workplace led Engstrom to describe tools as "transitional fluid entities" whose purpose changed according to the temporal and social context in which they found use. Public views of a river varied based upon whether they originated at the edge of a millpond, an inundated city block, the bow of a canal boat, or the boundary of a floodplain field. Capturing this range of uses, and the assumptions that they embedded about how to measure and distribute water, provides a key means of understanding the flow of water more broadly.

Given Engestrom's metaphorical explanation that tools were fluid entities, it may seem redundant to bring this language to the forefront of my work. Water needs no metaphors to

37 Susan Leigh Star, "The Ethnography of Infrastructure," *American Behavioral Scientist* 43, no. 3 (November 1, 1999): 377–91; Yrjö Engestrom, "When is a Tool" in *Learning, Working, Imagining: Twelve Studies in Activity Theory* (Helsinki: Orienta Konsultut Oy, 1990) 171-195.

account for its fluidity. When we think of the Connecticut River as a tool for working the landscape, however, this opens up a range of questions about the types of relationships we expect to find in the communities surrounding it. This results from the river's integration with the broader infrastructure of knowing and strategies for working with the landscape that defined life in the valley. Star and her colleague Karen Ruhleder describe infrastructures and systems whose existence and operation are characterized by their constant and unremarkable presence.[38] The flow of water through the valley provided a key indicator of the weather not because it was unexpected but because of its constant presence. At the same time, the use of water's flow as an indicator of the weather was a practice learned in the course of working the floodplain landscape rather than something packaged and taught independent of its use. Moreover, the flow of water provided a means of understanding the weather that existed as part of existing processes in society rather than being constructed *de novo.* Finally this practice of water use was integrated into the fabric of ordinary working lives, becoming visible upon its breakdown and dysfunction. The river constituted one element of the larger working landscape, and as long as it flowed within the range of social expectations, it guided how communities worked to shape the world where they lived, so if we wish to understand how people lived with water in the Early Republic, it behooves us to understand the array of relationships that they embedded the river within during these decades.

38 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 (March 1996): 111-134

Why Should Historians of the Early American Republic Care About How People Understood the Connecticut River?

This intensive investigation of how ordinary people understood the river that shaped their everyday lives within a single, thickly settled, river valley may open up new horizons in environmental history, but what does it mean to a historian of the Early Republic? As a field, the Early Republic originated in an effort during the early 1980s to foster synthesis among social historians working across the politically defined periodizations that governed the half-century following the ratification of the constitution.[39] In place of the Federalist, Jeffersonian, and Jacksonian periods, scholars looked for social trends that developed amidst these political transformations. In the process of developing these perspectives, ranging from work on the integration of capitalism into everyday life to reexamining fields including law, manufacturing, environmental change, westward expansion, and urbanization, the history of the Early Republic has grown into a field concerned with recontextualizing our understanding of how core institutions, concepts, and processes originated and developed during the first half century of United States history.[40] It covers a period where ideas about the roles of government and law;

39 Edward Pessen, "We Are All Jeffersonians, We Are All Jacksonians: Or a Pox on Stultifying Periodizations," *Journal of the Early Republic* 1, no. 1 (1981): 1–26.

40 See the articles in the roundtable on the state of the field, *Journal of the Early Republic* 24 no. 2 (Summer 2004), especially John L. Larson and Michael A. Morrison, "Whither the Early Republic? A Special Forum on the Future of the Field," *Journal of the Early Republic* 24, no. 2 (2004): 157–58; Brian Donahue, "Environmental Stewardship and Decline in Old New England," *Journal of the Early Republic* 24, no. 2 (2004): 234–41; Elizabeth A. Fenn, "Whither the Rest of the Continent?," *Journal of the Early Republic* 24, no. 2 (2004): 167–75; Ted Steinberg, "Down, Down, Down, No More: Environmental History Moves beyond Declension," *Journal of the Early Republic* 24, no. 2 (2004): 260–66; Ted Steinberg, "Interactive Landscapes... Embracing Those Aspects of Environmental History That Expose the Interactions of Human Beings with Climate, Plants, Animals, and Germs," *Journal of the Early Republic* 24, no. 2 (2004): 233–233; John Lauritz Larson and Michael A. Morrison, "Editors' Page: The Long Goodbye," *Journal of the Early Republic* 24, no. 2 (2004): 343–45.

urban and rural life; agriculture, commerce, and manufacturing; and gender, race, and class all remained not just unsettled, but subject to ongoing debate. During this period, the United States teemed with possibilities for development. It was a period that witnessed the construction of factories outside the established narratives of industrialization, the growth of cities outside established narratives of industrialization, and lives that did not prefigure the present. This has made the Early Republic a source of provocative questions about what it means to be a citizen of the United States as a historically and socially contingent process.

Reframing the periodization of the Early Republic as a unitary age dominated by diverse social-historical processes rather than a smaller series of politically discrete periods resulted, paradoxically, in the fragmentation of this new field. Carrying forward research agendas on all of these fronts simultaneously rendered synthesis difficult. When Theodore Steinberg published *Nature Incorporated* in 1991, he noted in his introduction that, "the tremendous attention paid to the Waltham-Lowell mills has prompted some to question whether our understanding of industrialization has been skewed. Indeed, most textile mills built in nineteenth-century New England were not based on the Waltham-Lowell model."[41] Steinberg argued a broader thesis that where capitalist enterprise commodified water use it operated under legal and social conditions that shaped the riverine landscapes. Steinberg's note about the atypicality of the Waltham-Lowell model in conjunction with his argument that different industrial orders had different environmental impacts raises a set of questions that have animated the development of this dissertation. First, if the scale and managerial character of water power development played a

41 Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Cambridge: Cambridge University Press, 1991) 10n; Jonathan Prude, *The Coming of Industrial Order: Town and Factory Life in Rural Massachusetts, 1810-1860* (Cambridge: Cambridge University Press, 1983).

crucial role in shaping its environmental impact, how did development differ between river systems? In the Connecticut River Valley a proliferation of small water power made it difficult to build a consensus among manufacturers that it was necessary to commodify water. At the same time, factories produced a variety of products including paper, lumber, machine tools, and textiles, all of which posed various and often contrasting demands on water availability. Both of these differences proved consequential in shaping how factories managed water on the landscape. Secondly, water use in manufacturing was not the only form of commodification occurring in the valley. If Steinberg's argument holds water for the industrial displacement of agriculture along the Merrimack, what does this say about strategies for working with water among the commercial farmers working the bottomlands of the Connecticut Valley, or the boatmen who operated the South Hadley Canal?

As noted above, one of the central factors making the Connecticut Valley in the early nineteenth century a unique place for the deployment of local knowledge was the existence of a democratic government. The Revolution had left communities certain of their ownership of the land but uncertain about their position within the state. The limitations of knowledge about the stewardship of established farms made questions of erosion at once questions about the future of civilization, questions about the future political power of established rural communities, and questions about agricultural improvement. It remained unclear whether the legislature or the judiciary ought to provide the forum for regulating river engineering projects, and it also remained unclear who held decisive authority to characterize how these projects would impact the flow of the river. The structure of institutional authority and the correct avenues for protest remained loosely defined, and even the boundary between executive exercise of the police power and judicial application of the law remained uncertain.[42] At the same time, hierarchies of authority grounded in class and propriety faced a challenge from below while expertise grounded in elite education among engineers and scientists did not exist. People in the valley inferred that the formation of the republic left discussions of land and water use in the hands of the communities affected by its use, but in reality corporate power operated across community boundaries. A tension existed between the desire to profit from the commodities produced by the landscape and the political necessity of stewardship and maintenance of the land.

There are several senses in which the tension between commodification and stewardship played out on the landscapes of the Early American Republic. Processes of erosion and deposition stood at the center of this tension as it shaped the land itself. Stephen Stoll argues that a political concern for the care of the land—as a proxy for maintaining the agrarian claims to political power in eastern states such as Virginia—prompted social responses to erosion and declining fertility during the Early Republic and Antebellum periods. Benjamin Cohen expanded on this work with his account of how farmers integrated their experience in restoring the fertility of fields with the emerging science of soil chemistry.[43] In the work of Cohen and Stoll, what might be called 'figuratively upstream' processes of erosion shaped politics, but in the work of Ari Kelman, the deposition of sediment in New Orleans, perhaps the exemplary downstream city, also created its own politics.[44] The French colonial tradition in Louisiana left the City of New Orleans with a civil code that made the Batture—land covered in floods but otherwise dry—

42 Jack Rakove, "The Origins of Judicial Review: A Plea for New Contexts"; Handlin and Handlin, *Commonwealth;* Balogh, *A Government Out of Sight*; Horwitz, *The Transformation of American Law.*

43 Benjamin R. Cohen, *Notes from the Ground: Science, Soil, and Society in the American Countryside* (New Haven: Yale, 2009); Steven Stoll, *Larding the Lean Earth: Soil and Society in Nineteenth-Century America* (New York: Hill and Wang, 2002).

public property. Tensions between the levee as public and private space got to the heart of a question of whether the social prerogatives at the heart of New Orleans Creole culture could function in an increasingly commercial world.

Kelman's work documenting the survival of a public landscape in a New Orleans that increasingly commodified real property emphasized how society fostered values and relationships with natural processes whose significance extended beyond commodification. This work, alongside Conevery Bolton Valenčius' *The Health of the Country* emphasized how encounters with water as an elemental aspect of the world shaped people's everyday lives.[45] Valenčius studied the mutual implications of landscape and health, arguing that the embodied experience of everyday life in the Early Republic depended on a sense of the healthfulness or sickliness of the landscape. Landscapes did not simply exist as private and public property for the enactment of social customs such as promenades or Mardi Gras fetes, but also as an elemental source of sustenance for their inhabitants. The historical significance of landscape lay not just in how people made them, but in what they made of people.

As Steinberg's work reminded us, however, landscapes could produce commodities for a larger market without actually commodifying the land or water that contributed to their production. While political power vested in the territorial boundaries of individual jurisdictions with their own governments, economic power ranged across political boundaries, moving commodities from the landscapes of production to the cities where they were consumed. This history of commodification in agriculture—documented in works ranging from William Cronon's

44 Ari Kelman, *A River and Its City: The Nature of Landscape in New Orleans* (Berkeley: University of California Press, 2003).

45 Valenčius, *The Health of the Country.*

account of wheat grading in the Midwest to Emily Pawley's work on the identification, propagation and marketing of fruit varieties in Upstate New York—illustrated some of the difficulties associated with thinking in landscapes.[46] Commodities presented a problem for residents of the Connecticut Valley because bulk production, whether it was in wheat, beef, broom corn, or tobacco, proved fungible with that of competing agricultural areas that often produced on a larger scale. The markets in Boston and New York City did not care about the provenance of their produce, and this accounts for some of the political uncertainty that upland farmers expressed when imagining the political consequences of soil exhaustion and outmigration.

Economic concerns for commodification and political concerns for stewardship existed in a tension that connected the settled states on the East Coast with the multiple processes of continental settlement and empire building occurring across North America. Indeed, it would not be difficult to trace connections between a concern for soil fertility in New England and networks of trade stretching across the Western Hemisphere and into the Pacific World.[47] But commodification occurs in landscapes, and the communities that lived in the nineteenth-century Connecticut Valley thought of their landscapes in terms of their local relationships. This perspective did not define the whole story of their lives, but it did establish key elements of that story. Because residents of the Connecticut River Valley situated temporality in the flow of water across the landscape, they used these temporal contexts to assess landscape change within the

46 William Cronon, *Nature's Metropolis: Chicago and the Great West*, (New York: W. W. Norton, 1991); Emily Pawley, "The Balance Sheet of Nature: Calculating the New York Farm, 1820-1860" (Ph. D Dissertation: University of Pennsylvania, 2009).

47 Gregory T. Cushman, *Guano and the Opening of the Pacific World: A Global Ecological History* (New York: Cambridge University Press, 2013).

Early Republic. This meant that they applied this knowledge in their efforts at shaping the politics of industrialization and urbanization. The search for this time signature sits at the center of this dissertation.

Chapter Summary

The first chapter analyzes the flow of water as a timekeeper, indicating the rhythms of seasonal change. It asks how farmers interpreted seasonal patterns in the flow of water independent of conflicts over water use. It answers by using farm diaries and agricultural periodicals to describe a typical year in which water facilitated the organization of work around patterns of climate and weather. In these sources, water appears as a heuristic tool for understanding seasonal patterns in local weather. Its flow defines the succession of farm tasks throughout the year, making seasonality a means of coordinating work with the process by which the physical character of the landscape changed indicates a key element of early nineteenth-century agriculture. In subsequent chapters, seasonal understandings of water's flow will play a central role in disputes over water use. Thus, a grounding in how the flow of water shaped people's everyday lives will contextualize the protests that riparian communities raised in response to proposed alterations in the river.

The second chapter examines how people situated water's flow within longer geological timescales. It musters evidence that the valley's residents understood the flow of the river as the product of its status as an ancient lake and explores how communities deployed their knowledge of the river's history in the context of proposals to redirect its course. While the previous chapter explored how the flow of water shaped working practices, this chapter explores how the river shaped strategies for reading, using, and reenvisioning the landscape. This knowledge helped farmers on the floodplain understand how the soil formed and what uses it had. To situate this knowledge, it explores how Timothy Dwight learned from local farmers in his accounts of how water shaped the landscape. These farmers understood that the floodplain at large had been formed from the bottoms of an ancient lake and that the river's course across this lake had changed over the preceding millennia. It builds on the overview of ordinary land use as a factor shaping geology by exploring how farmers in West Springfield's Agawam Meadows applied their knowledge of the river's historical channels when responding to river engineering proposals. In their protests, meadow landowners combined an understanding of how seasonal flooding shaped erosion with observations of the shifting channel visible upon the landscape to explain the factors that would make river engineering difficult and unprofitable.

While these two accounts of temporality on the river do their best to keep the relationships between seasonal, geological, and historical time separate, they simplify this analysis of what people in the valley knew about the flow of water, particularly in relation to historical time. In the next two chapters, which explore how this understanding of the flow of water shaped water use strategies in historical time, these perspectives jostle and compete with one another in larger debates over the place of water in public life. The flow of water helped shape work, landscapes, and property regimes within the valley, and a vocal element in the region insisted that the river be taken as a given object, to be worked around rather than engineered. This perspective exercised sway in many dimensions of water use.

The third chapter explores how the controversies surrounding the management of the South Hadley Canal exemplified temporality as a force shaping the practices of water use. The owners of the canal, the Proprietors of Locks and Canals on Connecticut River, faced a design choice between reshaping either the geology of the falls or the seasonal flow of water through the falls. In the operation of the canal, the proprietors faced continual pressure from upstream farmers to minimize their disruption of water's flow while also responding to pressure from boatmen to maximize capacity for shipping in the canal. Using the records of the proprietors and the documents arising from legislative and legal complaints against them, this chapter documents how the canal company navigated a series of compromises with upstream landowners without disrupting service to shippers. The compromises that made the canal work, were not, however, final settlements of the canal's status. As floods repeatedly washed away the canal dam, the upstream communities that objected to the dam initiated new suits to make this removal permanent. Similar protests cropped up when increased demands for shipping prompted the expansion of the canal's channel.

The fourth chapter looks at the changing use of historical memory in legal conflicts over water power. In environments where limitations on capital and property rendered flows uncertain, mill owners who shared privileges with their neighbors depended on cooperative efforts at water management. Ironically, this cooperation comes through most clearly in legal battles over water rights that occurred when proposals for the maintenance and expansion of water power systems revealed underlying disagreements about how to manage the flow of water. Unlike touchstones of industrial development such as Lowell on the Merrimack River and Waltham on the Charles River, the fall lines under consideration in this chapter lacked a central corporate arbiter that controlled machinery design and measured water consumption. Four legal cases decided between 1821 and 1863 document changing definitions of water rights, and the disagreements that arose in the exercise of these water rights. These cases illustrate how the parties to water-sharing agreements measured the water that they divided, and what types of evidence they used to demonstrate the fulfillment of the water-sharing agreements in which they participated. This chapter examines the language of water-sharing contracts specifying how the historical memory of water use in specific places jostled against the need for innovation in water management.

The fifth chapter asks how large scale industry came to dominate the reach of the river between South Hadley Falls and Northampton as well as how this industry redefined water use. This narrative consists of two discrete but connected processes, the disconnection of water use practices from everyday life upstream from the falls, and the increasingly specialized practices of water management at the falls. While the erosion of land upstream created problems for farmers who ordinarily focused their protests on the canal, disputes over water distribution among the factories that had grown at South Hadley Falls created incentives for the metering and distribution of water. These disputes over water contributed to a desire for engineering solutions to manage the river's erosive power upstream alongside a desire for quantified and rationally distributed water downstream. Water meters transformed South Hadley Falls from a site of improvised water management practices to an enclave where water power could be measured and distributed on an open market. Erosion prevention systems disconnected the slow geological force of the water on the riverbank from the conditions of property ownership on the floodplain itself. Each of these processes disconnected individual communities from the variations in landscape that defined thinking like a floodplain.

The sixth chapter asks what forms of geological and seasonal knowledge people used in their efforts at living with floodwaters in Hartford, Connecticut, and it also explores the priorities and problems that encouraged the development of flood control systems for parts of the city. This chapter argues that communities in Hartford's East Side neighborhood continued to adapt to floodwaters even as private industries such as railroads and manufacturing invested in flood control projects that protected their own infrastructure. Using municipal, corporate, and journalistic accounts, it explores different perspectives within the city about flooding as a social event and a physical problem.

The chapters in this dissertation formulate answers to the question of what it meant to think like a floodplain. How did the timescales governing seasonal variations in the river's flow and geomorphological changes in the landscape shape contemporary accounts of the flow of water? How did the tension between the visible flows that defined the river and the submerged temporalities that guided the changing landscape shape industrial forms of water use? Throughout the process of industrialization and urbanization, debates over landscape change and water use became debates over temporality. These debates provided a window into a society that participated in the maturation of American capitalism while simultaneously protesting its efforts at asserting control over the floodplain, and indeed its efforts at asserting control over nature. This illustrated a broader tension at work in debates over water management: Controlling nature entailed some measure of acceptance of nature's power and adaptation to the paths taken by that power. The extent and significance of how people adapted their work to the floodplain's changing character forms the center of this work.

Chapter One:
Residence Times: Water as a Tool for Understanding Seasonal Change in the Connecticut River Valley, 1790-1870

In March, 1801, the Connecticut River flooded to a height unseen in the preceding century. This flood reached twenty-seven feet six inches at Hartford, Connecticut, approximately seven feet higher than the average high water, and the flood marks on buildings in town would provide a reference point for comparing all subsequent flood heights for the next half century. Despite this remarkable magnitude, the flood had few of the dramatic characteristics that we might associate with a disaster. Windsor, Connecticut resident Abner Reed observed a "flood so as to cover the stable floor and come within two feet of the N[orth] side of the house and in the street below the south end of the house."[1] Typical of records describing flooding in the early nineteenth-century valley, he does not mention the repercussions of high water. Indeed, the patterns of precipitation leading into this flood were treated in far greater detail than any of its social consequences. His diary recorded the severe storms that occurred between the seventeenth and the twentieth of March that provided most of the floodwaters in 1801, but he also noted that rain had fallen every day since the beginning of the month. The month's precipitation had saturated the ground in places that were not still frozen and thawed whatever snow and ice remained, making this final rainstorm a dramatic exclamation point of the thaw that marked the end of winter.[2] Reed recorded the flood event as an indicator of seasonal transition marked by the flow of water across the landscape, a reference suggesting that seasonal transitions had longer

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1 Abner Reed, Diary, 21 March 1801, Connecticut Historical Society (CHS), Hartford.

2 Abner Reed, Diary, 1-20 March 1801; "By Reason of the Heavy Rains" *Connecticut Courant* (23 March 1801):3 all *Courant* articles accessed through Proquest historical newspapers.

lasting consequences than floods. Floodwaters created an image of disruption when present upon the landscape, but did little to shape the working relationship with the landscape.

Part of the reason why flooding merited mention, but little discussion, in this context was that land use practices in the town of Windsor meant that high water did not necessarily wash away homes or livelihoods. Indeed, on the north side of town in Pine Meadow village, now called Windsor Locks, the narrower meadowlands allowed floodwaters to reach at least one house and carry off the andirons from the family's fireplace.[3] While this indicated that the worst floods reached people's houses, the presence of mere inches of water rather than the wholesale loss of the house indicated that most valley residents' successful adaptation of the built environment to the flows of the river.[4] Communities whose dwellings remained above the reach of floodwaters, but whose fields depended on those same waters for an annual deposit of silt, experienced flooding as a sign of seasonal change and enrichment rather than a cause for alarm.

Timothy Dwight's 1796 account of the village of Windsor described a seven-mile-long chain of houses following the thread of a river terrace elevated above the general high water mark.[5] Building houses and streets above the freshet line provided some protection from flooding in the river towns lining the Connecticut Valley, but it was not just a response to the risk of flooding. Communities in the valley understood the superior quality of the lowlands for

3 Henry Stiles, *History and Genealogies of Ancient Windsor, Connecticut* (Hartford: Case, Lockwood, and Brainard, 1883) 1:502.

4 This extends the contrast between flooding as ordinary process and flooding as a catastrophe developed in Stéphane Castonguay, "The Production of Flood as Natural Catastrophe: Extreme Events and the Construction of Vulnerability in the Drainage Basin of the St. Francis River (quebec), Mid-Nineteenth to Mid-Twentieth Century.," *Environmental History* 12, no. 4 (October 2007): 820–44.

5 Seth Pease, "Map of Windsor, Shewing the Parishes, the Roads, and Houses" 1798, CHS http://hdl.handle.net/11134/40002:15035.

cultivation and worked to take advantage of the deposits of silt during collected on these lands during winter and spring floods. Between central Connecticut and northern Massachusetts, the floor of the river valley spread into a wide floodplain consisting of the silt deposited by an ancient lakebed and washed by millennia of subsequent floodwaters. Instead of fearing torrents running down steep slopes, residents of the Connecticut River floodplain understood that their production cycles depended on floodwaters that moved slowly across the broad bottomlands of the river over days or even weeks.

Diarists in the Connecticut River Valley described the flow of water in detail when accounting for how individual events fit into seasonal patterns. Water provided the most visible indicator of seasonal change on the landscape, and farming depended on an accurate understanding of such changes. The spring flood was one of a variety of flows that defined the water year, but its importance comes through most clearly when situated in the full annual cycle.[6] Diaries from across the valley showed surprising continuity in their rural, floodplain-oriented, worldviews. This approach held even as dams, reservoirs, aqueducts, ditches, sewers, and levees reshaped water management throughout the Early Republic. Debates over water use regularly drew upon seasonally and geologically grounded understandings of its flow, making seasonality a touchstone for understanding how communities criticized and sought to shape industrialization. The sources at the center of this chapter consist of diaries and reflective essays from farm

6 J.R. Slack and Jurate Maciunas Landwehr, “Hydro-Climatic Data Network (HCDN); a U.S. Geological Survey Streamflow Data Set for the United States for the Study of Climate Variations, 1874-1988,” USGS Open-File Report 92-129 (U.S. Geological Survey, 1992), http://pubs.er.usgs.gov/publication/ofr92129 defines the water year as beginning on September thirtieth. This effectively categorizes all winter precipitation in the same water year with the summer in which it would be used in agriculture, but is less about water availability and distribution than it is about localized understandings of water's flow.

periodicals, each of which organized the experience of living and working in New England and sought to frame the work that ought to occur during different months of the year.

Seasonality existed independent of what might be called 'watershed consciousness.'[7] Communities were able to pay careful attention to the flow of water across the landscape without understanding the river as a whole.[8] Instead, they could interpret them in light of their past experience observing similar flows. These observations also provided fodder for understanding how water's flows contributed to erosion and the shifting channel of the river itself. Weather—as framed in terms of water's flow—and geomorphic changes in the river channel shared a common feature in that they both described the action of water beyond direct human control. Communities understood the flow of water as it passed their homes; they timed their agricultural work based upon the changing seasonal flow of water; and they articulated their concerns about the reengineering of the river based upon this analysis of the seasonal flow of water. Thus, understanding how people interpreted water's changing seasonal flow provides an essential component for understanding how communities in the Connecticut River Valley understood their river.

The seasonal cycles that diarists read in the flow of water represented a timescale defined by natural processes outside of direct human control. As in Reed's hometown of Windsor, valley residents worked to design a built environment adapted to seasonal change even as the dramatic social changes that accompanied industrialization, rural improvement, and urban growth

7 Ashley Carse, *Beyond the Big Ditch: Politics, Ecology, and Infrastructure at the Panama Canal* (Cambridge: MIT Press, 2014) p. 4 n2; Jamie Linton, *What Is Water?: The History of a Modern Abstraction* (Vancouver: UBC Press, 2010).

8 This critique of watershed thinking builds on Edella Schlager and William A Blomquist, *Embracing Watershed Politics* (Boulder: University Press of Colorado, 2008); and *Beyond the Big Ditch*

transformed the landscape. They did not object to the perennial presence of floodwaters in general, but rather they argued that specific points in time, particularly the spring floods associated with the thaw, would create specific problems of flooding. They understood that specific forms of infrastructure would change the landscape and create or exacerbate flood problems. The first step in recreating the frame of mind that governed responses to industrialization in the Connecticut River Valley consists of an exploration of how individual farmers and artisans accounted for seasonal variations in the flow of water across the landscape.

Water as an Indicator of Seasonal Succession

Weather diaries such as Reed's used the flow of water as a medium for sorting between the signal and the noise in the course of seasonal change. The key question in his mind was not the severity of the 1801 flood, but whether that flood marked the thaw and a transition from winter into the muddy chill of early spring. He was not interested in finding the largest flood observable, but in how to divide weather between ephemeral events—isolated rainstorms and warm spells—and the cumulative processes of seasonal change. An ephemeral event could prove consequential in the process of seasonal work, but the goal of recording weather, and particularly weather as measured by the flow of water, rather than the temperature or the barometric pressure, lay in the identification of seasonal changes and the timing of working practices in accord with the changing flow of water. In this sense, weather diaries provide a window into how seasonal weather patterns transformed working landscapes in the valley.[9]

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9 Hannes Palang, Helen Sooväli, and Anu Printsmann, eds., *Seasonal Landscapes* (Dordrecht: Springer, 2007); Kenneth Olwig, "Liminality, Seasonality and Landscape," *Landscape Research* 30, no. 2 (2005): 259–71.

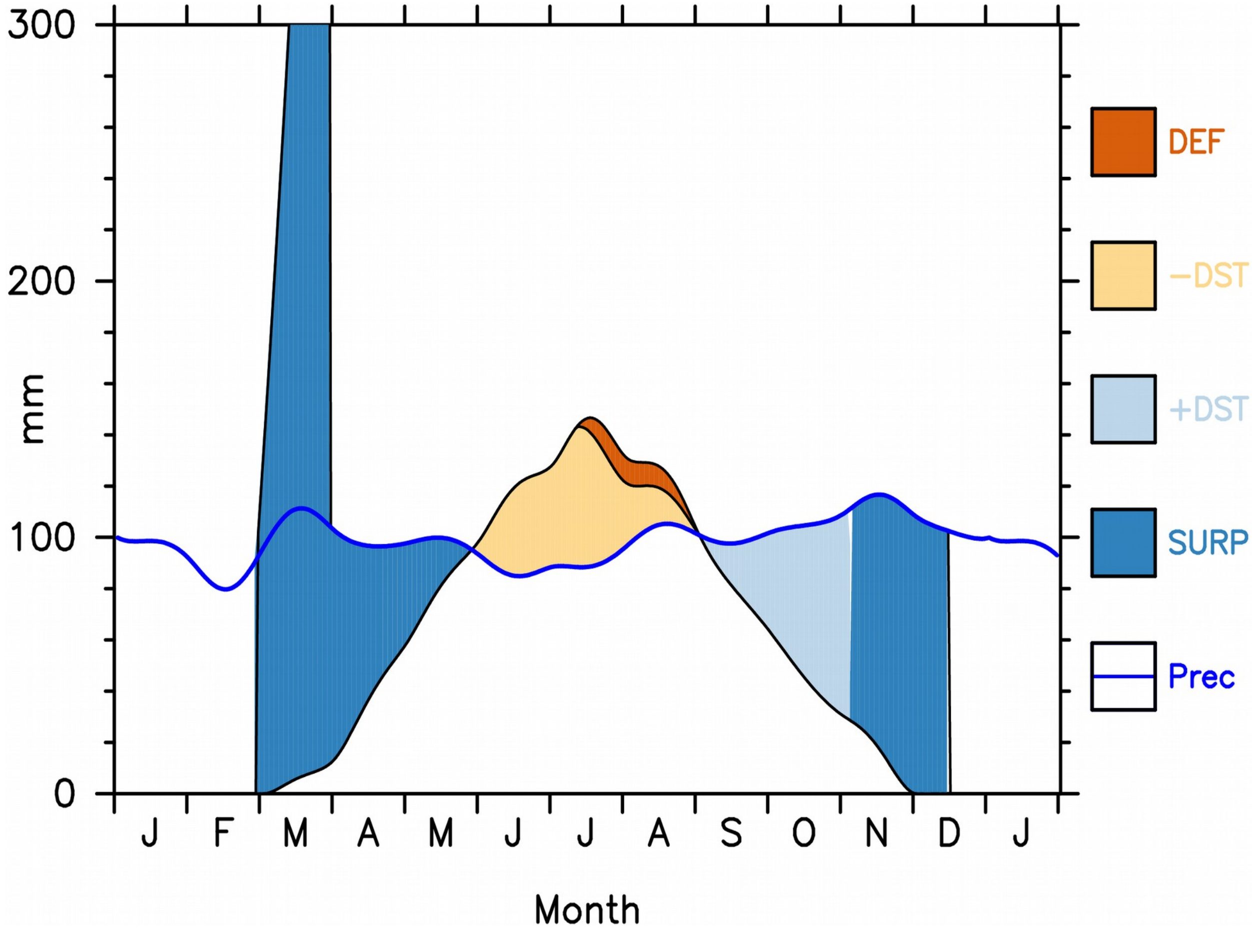

Figure 2: Water Budget Graph for coordinates 72.5 West, 42 North (vicinity of Holyoke, Massachusetts) from Web WIMP, geog.udel.edu/~wimp

During each of the four seasons a shifting array of meteorological processes set the rhythm by which water shaped the Connecticut Valley landscape. Reconstructing this rhythm helps explain how the water year informed a landscape-driven understanding of climate that governed people's working practices. The water year typically began in spring with the thaw and freshet, an event whose timing could vary considerably, but which typically occurred in March. The work of spring planting began as the ground dried after the flood and generally carried on through May. After its completion, the labor of summer stretched between June and August. In late August or early September, the fall harvest, coincided with a season of maintenance, when farmers shored up and winterized systems governing the flow of water across the farm ranging from drainage ditches to water lines. Between the killing frost and the first snows, winter began, with the accumulation of snow marking the end of the water year.

The water year divides neatly in half, with winter and spring being distinguished by the accumulation of significant quantities of water that ran off in the dramatic floods of the spring freshet, while summer and fall were distinguished by episodic and ephemeral flows. The *cumulative-ephemeral* distinction made a difference in weather record-keeping, as diarists paid close attention to the *cumulative* weather patterns that shaped the landscape during winter and spring, they did not use the same approach to measurement in assessing the flow of water in for summer and fall. While the accumulation of water on the landscape as frost, snow, ice, and mud defined working practices during winter and spring, more ephemeral flows ranging from dew to tropical storms defined the flow of water in the summer and fall. Snow and ice accumulated during the winter and ran off in an annual process of thaw and flood. Droughts and storms struck during the summer and fall as episodic events that could reshape the landscape *ephemerally*, but their unpredictability meant that they did not define the season itself. That being said, the diminished flow of water in summer and fall did not diminish its importance. Farmers needed these smaller flows to grow crops and the drier weather also enabled the crucial maintenance and rebuilding of water management infrastructure.[10]

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10 Paul Brassley, “On the Unrecognized Significance of the Ephemeral Landscape,” *Landscape Research* 23, no. 2 (1998): 119–32; For an overview of cumulative landscapes see Michael P. Conzen, ed., *The Making of the American Landscape*, (New York: Routledge, 2010) p. 4-5, who uses a historical rather than a seasonal timescale, but still addresses important questions on the topic.

The *cumulative* flows of water in winter and spring shaped patterns of water use throughout the year on farms in the Connecticut River Valley. These flows attracted the majority of attention from diarists recording the weather and they merited regular mention in agricultural periodicals such as the *New England Farmer*. While the period from 1790 to 1870 saw dramatic changes in farm work, these changes fit into a rhythm of seasonal succession whose regularity lent continuity to everyday life in the valley. Every year, the ice thawed, snow melted, and frozen ground turned into mud, and the mud dried. Throughout this process, *cumulative* seasonality during the winter and spring provided the overarching context for understanding the flow of water in the Connecticut and its tributaries.

Ephemeral flows in the summer and fall shaped days, but not whole weeks and certainly not seasons. Farming also depended on assessing the ephemeral signs of seasonal change on the landscape accurately and coordinating the agricultural year in tune with the water year. While spring floods and winter snow marked clear points of seasonal transition, the same could not be said for the boundary between spring and summer or summer and fall. Patterns in the flow of water did not change in an easily identifiable way. Absent were the phase changes that it made as it froze at the beginning of winter or thawed at the beginning of spring. Instead, farmers relied on nonhydrological boundaries to understand how late spring shaded into early summer and late summer into early fall. But even as the flow of water itself remained *ephemeral* during the summer, farming the floodplains of the Connecticut River Valley entailed working silt that had accumulated through millennia of flooding, meaning that the soil provided a consistent reminder of the cumulative power of water in shaping the landscape.

The graph above depicts the water budget of Holyoke, Massachusetts during the thirty years from1985-2015. The absolute numbers that it depicts are not accurate for the period 1790-1870, but historical climatologists describe this region as having been subject to a pattern of extreme rainfall, or an epic pluvial, between 1800 and 2010, making this graph a reasonable representation of any given year's precipitation pattern, traced in the line marked (Prec), and its consequences for run-off, soil moisture, and plant growth.[11] In this model, the calendar year begins with virtually no runoff or storage because of the frost cover on the ground and an average temperature below freezing, which we will see below is not a wholly accurate depiction of winter weather, but it provides a helpful simplifying measure here. During the month of March, the whole accumulation of winter snow melts, creating the massive volumes of surplus water marked by the solid blue block (SURP). During the middle of May, in one of these average years, the surplus water finishes running off, and plant transpiration combines with evaporation to draw down surplus water (DST-) until the region experiences mild water deficits (DEF) during June, July and August. The lower temperatures and ending plant lifecycles of September and October contribute to the growing storage of water (DST+), depicted in light blue on the graph, shading into surplus during November and December, and freezing once again in mid-December. As we will see in this chapter, although volumes of precipitation (Prec.) remained relatively constant throughout the year, diarists focused most clearly on the period between mid-December and May when precipitation contributed materially to accumulation, leaving the periods of water

11 Neil Pederson et al., "Is an Epic Pluvial Masking the Water Insecurity of the Greater New York City Region?" *Journal of Climate* 26, no. 4 (February 1, 2013): 1339–54. This paper uses historical climate data from the Connecticut Valley.

drawdown and replenishment—periods characterized by ephemeral rainfall—little remarked upon.

The patterns that defined the flow of water in different seasons help to situate the upcoming chapters. These later chapters explore how processes of river engineering, dam building, and transportation improvement challenged people's expectations of continuity and stability in water's flow. But on a fundamental level, adaptation to water's surplus and deficit, to the cumulative and ephemeral flow of water largely defined what it meant to think like a floodplain. The process of accommodation to seasonal change can help to explain the perspectives that communities brought to bear on the transformation of the landscape through industrialization and urbanization. The interplay of cumulative and ephemeral flows set the rhythm of seasonal cycles in the Connecticut River Valley. Periods of cumulative flow challenged farmers to work around frost, snowdrifts, floodwaters, and mud, while periods of ephemeral flow challenged farmers to keep their soil aerated, and gamble on the timing of mowing and harvesting. These were landscapes where the rhythms of time's passage were "constructed by its interpreter, and that interpretation [was] informed by the experience of data from the past."[12] Farmers in the Connecticut Valley spent their lifetimes working with the landscape and used this accumulating wealth of knowledge to guide their working lives.

Phase changes in water—freezing, thaw, evaporation and renewed freezing—defined the boundaries between three of the four seasons in the Connecticut Valley of the Early Republic. The frosts of autumn gave way to the freezes of winter, which continued through the spring thaw and the drying of the ground during summer. The transition from summer into fall remained

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12 V. I. Hodder quoted in Barbara Bender, "Time and Landscape" *Current Anthropology* 43 Supplement (August-October 2002): S104.

something of a grey area because it lacked an obvious hydrological indicator. This left some observers at a loss to understand the boundary between summer and fall, as the *New England Farmer* observed by quoting Peter Patmore: "August is that debatable ground of the year, which is situated exactly upon the confines of Summer and Autumn; and it is difficult to say which has the better claim to it. It is dressed in half the flowers of the one, and half the fruits of the other, and it has a sky and temperature all its own."[13] Thus, as we will see below, the relatively dry period during the transition from the summer to the fall provided an opportunity to shore up water-supply systems and adapt farm buildings to the improved management of water. Even when the seasons did not depend exclusively on the flow of water, they still occupied distinct places within the valley's water year.

Like the spring freshet, which was generally the definitive event of the water year in the Connecticut River Valley, analyzing variations in relationships with water across the seasons pushes our analysis past the riverbanks. Ordinary people paid close attention to water when assessing levels of soil moisture in a field, the volumes of water held back by a millpond, or the severity of a rainstorm. Paying attention to this continuum of labor interacting with soil moisture, precipitation, rivers, springs, lakes and millponds paints a picture of a community that did not take water for granted. In exploring the dimensions of water use, we can come to understand how seasonality shaped relationships with water beyond the river's edge. It extended outward onto the land, making the Connecticut River a central player, but not the only factor in the history of water use choices in the nineteenth-century. This work steps beyond the banks of the river to

13 Peter Patmore quoted in "Seasonable Suggestions" *New England Farmer* 8 no. 8 (August 1856); Patmore, *Mirror of the Months* (London: George Whittaker, 1826) p. 169-70.

explain how interactions between the river's channel, groundwater flow, and soil moisture combined to shape human water use.[14]

The uses of water mediated how people experienced the relationship between the climate and the landscape. Attention to seasonal cycles focuses on *how* water flowed through the Connecticut Valley rather than *how much* water flowed through the valley. Studies of nineteenth-century water use tend to take the opposite approach, searching for changes in water availability driven by deforestation and industrial development.[15] Such an approach reinforces the sense that the river is a reservoir—essentially a bucket with set quantities of water—rather than a place characterized by water's variable flow. Before we can talk about the changing quantities of water in the river, however, we need to establish how and why water came to be quantified. Recapturing perspectives on water from a period before its regimentation into quantified and manageable reservoirs requires us to reimagine a bygone hydro-social relationship.[16] It reintroduces us to communities who organized their lives around the accommodation of nature

14 For similar reasons, historian Christopher Morris framed the history of the Lower Mississippi as a history of mud rather than a history of water or soil alone *The Big Muddy: An Environmental History of the Mississippi and its Peoples From De Soto to Hurricane Katrina* (New York: Oxford University Press, 2012); Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (New York: Cambridge University Press, 1991); Thomas Winter, Judson Harvey, O. Lehn Franke, and William M. Alley, "Groundwater and Surface Water: A Single Resource" United States Geological Survey Circular 1139 (1998); Brian Donahue, "'Dammed at Both Ends and Cursed in the Middle:' The 'Flowage' of the Concord River Meadows, 1798 – 1862," *Environmental Review: ER* 13, no. 3/4 (October 1989): 47–67.

15 John Cumbler, *Reasonable Use: The People, the Environment, and the State, New England, 1790-1930* (Oxford: Oxford University Press, 2001); Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Cambridge: Cambridge University Press, 1991).

16 Erik Swyngedouw, "The Political Economy and Political Ecology of the Hydro-Social Cycle," *Journal of Contemporary Water Research & Education* 142, no. 1 (August 1, 2009): 56–60, doi:10.1111/j.1936-704X.2009.00054.x.

rather than its mastery. Some scholarship in human geography argues that focusing primarily on the quantitative elements of water, treating river valleys as spaces with specific volumes of water available for consumption, reduces it to an ecologically neutral substance open to appropriation and commodification. This scholarship challenges historians to reconstruct how communities dealt with water in a qualitative context, such as how people worked with physical changes in its flow that occurred in different seasons.[17] Residents of the Connecticut River Valley during the Early Republic paid close attention to seasonal cycles and processes of erosion and deposition that situated water's flow within the soil. Such a distinction refocuses historical accounts of water use away from its appropriation and toward the work that people expected water to facilitate. This qualitative understanding of water played a key role in the everyday life of farmers in the Connecticut Valley during the nineteenth century—as we will see in this chapter—but it will also carry forward as competing rural and urban understandings of floodwaters, water allocation for manufacturing, and the design of water-supply systems spread throughout the valley.

Despite the fact that residents of the nineteenth-century Connecticut Valley did not have control over the flow of water, they experienced a hybrid culture entangling them with the flow of water because their definitions of how water's flow varied shaped the character of work upon the landscape. The greater dependence on water's local flows for the products of everyday life meant that access to water shaped culture at large. Water permeated everyday life and shaped work beyond the power of its flow. Water's flow actually set the timing for work. Conevery

17 Jamie Linton, "Is the Hydrologic Cycle Sustainable? A Historical-Geographical Critique of a Modern Concept.," *Annals of the Association of American Geographers* 98, no. 3 (2008): 630–49, doi:10.1080/00045600802046619; Linton, *What Is Water?: The History of a Modern Abstraction* (Vancouver: UBC Press, 2010).

Bolton Valenčius described this in *The Health of the County* when she stressed that "to an extent foreign to us moderns, the waters of a place defined and characterized it for nineteenth century people." There was virtually no separation between the act of working with water and the cognate acts of drinking that water, living with its high flows and adapting to its low flows. Indeed, we may conclude with Valenčius that water's "presence or absence, the taste, flow and color of water could define the world in practical terms" for people reliant on their local water supply for survival.[18] Insofar as communities in the Early Republic hybridized the landscape, they simultaneously hybridized themselves. The natural advantages and disadvantages of the country determined the strength and character of its settlers. This chapter moves the focus of this relationship from the body to the landscape, exploring how New Englanders lived and worked on a landscape that varied seasonally. The power of water in this regional context lay not just in the work it performed, but also in the work that it allowed. This premise expands the scope of river history from the channel onto the river's banks and broadens our understanding of a hybrid landscape to encompass a landscape that transformed its inhabitants.

The Connecticut River and its constituent flows of water across the landscape peeled out the rhythms of seasonal time in the Valley.[19] Seasonal time shaped community life and social identity. The river established a sense of natural time that changed cyclically, but varied in the

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18 Conevery Bolton Valenčius, *The Health of the Country: How American Settlers Understood Themselves and Their Land*, (New York: Basic Books, 2002) p. 133; A similar work pushing this perspective forward—not to mention westward—was Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge* (Berkeley: University of California Press, 2006).

19 Tim Edensor, *Geographies of Rhythm: Nature, Place, Mobilities and Bodies* (Burlington, VT: Ashgate Publishing, 2012); Henri Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life* (London ; New York: Continuum, 2004). uses the metronome as a metaphor; Adam, *Time and Social Theory*, 76-81 argues that mechanical metaphors oversimplify time's passage.

period of its cycles. It did not follow a set calendar that divided the day into hours and minutes or the year into days and weeks, but its patterns were regular enough that most diarists read the seasons in the river's flow. Historians have dealt extensively with the transformations wrought by clock time, but the significance of the so-called natural rhythms of time that the clock displaced remain little explored.[20] One of the key elements of sources helping to recreate how rivers marked time in the Early Republic is their integration of linear time with its unpredictable cyclical counterpart in seasonal change. When confronted with unusual weather, diarists who were following the rhythms of seasonal change recorded entries that sounded like an effort to keep up with an erratic dance partner who insisted on leading.[21]

The remainder of this chapter applies the premise that seasonal processes on a hybrid landscape shaped perceptions of time by altering the physical landscape according to a rhythm

20 Social time plays a significant role in the historiography of industrialization in Great Britain E. P. Thompson, "Time, Work-Discipline, and Industrial Capitalism," *Past & Present*, no. 38 (December 1, 1967): 56–97 which introduces the key distinction between task orientation and time orientation; See also the criticism of Thompson in Paul Glennie and Nigel Thrift, "Reworking E. P. Thompson's 'Time, Work-Discipline and Industrial Capitalism,'" *Time & Society* 5, no. 3 (1996): 275–99; and Michael O'Malley, "Time, Work, and Task Orientation: A Critique of American Historiography" *Time and Society* 1 no. 3 (1992):341-358; The best work on time and nature is by Barbara Adam, whose works include *Time and Social Theory* (Philadelphia: Temple University Press, 1990); idem, *Timewatch: The Social Analysis of Time* (Cambridge: Polity Press, 1995); Idem., *Time: Key Concepts* (Cambridge: Polity, 2004); idem., "Social Time Versus Natural Time," in Michael Dunlop Young and Tom Schuller, eds. *The Rhythms of Society* (London ; New York: Routledge, 1988), 198–226; another notable exception appears in Robert Poole, *Time's Alteration: Calendar Reform in Early Modern England* (London: UCL Press, 1998) which pays extensive attention to the nature of the day as a means of marking time before the advent of clock time. The forms of time discussed here are shorter in period than Robert Paynter, "Time in the Valley: Narratives about Rural New England," *Current Anthropology* 43, no. S4 (August 1, 2002): S85–101; On the use of the diurnal form of the diary or planner see Molly McCarthy, *The Accidental Diarist* (Chicago: University of Chicago Press, 2013).

21 Henri Lefebvre, *Rhythmanalysis* p. 74-7 Rhythm recurs during this chapter, but it will play a broader conceptual role as the next chapter introduces the linear process of geological change alongside seasonal cycles.

predictable in its steps if not in their precise timing. In sections devoted to the four seasons, it reconstructs a typical year and explores how people mapped both their experiences of the weather and their expectations of the climate onto that year. The flow of water provided a heuristic tool for understanding how seasonal change shaped the landscape, and this, in turn, provided a means of scheduling and pacing work as a function of seasonal changes. Because water acted as a tool of cultivation in contexts ranging from particular fields to the river as a whole, it also provided a means of judging the broader seasonal processes that made the river workable. The reciprocal relationship between the flow of water and the weather provided many Connecticut Valley residents with an indicator of how well the individual years fit into their broader sense of climatic norms.

Spring

The spring set the tone for the water year. It began with the slow drip of meltwater during the thaw and continued through the freshet into what is now called mud season. The dramatic landscape changes of spring ushered in the intensive work of plowing and planting. The volatility of spring weather contributed processes like flooding that kept the land cultivable over the long run, but remained an obstacle to cultivation in the short run. Temperatures that rose above freezing during the day and fell below freezing at night set patterns in the flow of water during springtime. This controlled a variety of processes ranging from the running of sap in sugar maples to the sometimes devastating floods along the region's rivers. The thaw proceeded slowly and haltingly in a stutter step. Consequently, it demanded steady attention, for disaster could strike quickly, even if the possibilities for work in its midst remained minimal.[22] As

22 Gregory A. Zielinski, *New England Weather, New England Climate* (Lebanon, NH: University Press of New England, 2003).

floodwater receded and sap flows stopped, mud season ended and the ground became dry enough to take a plow. Rather than a single instantaneous change from freezing to thaw, the spring was characterized by a rhythm that alternated between the two.

Given the rapidity with which the thaw could lead into a renewed bout of ice and snow, any claim that the weather had turned to spring remained contingent. During the middle of April, David Hoyt, a farmer from Deerfield described warm, thawing days as spring like days rather than denominating them as springtime.[23] When this liminality appeared in descriptions of weather outside of springtime, diarists described it as springlike. His son Jonathan described the thawed out and muddy landscape of December 1800 as one that "looks like a forward spring."[24] On April sixteenth, 1805 he commented on the "forward spring," where "Some people have planted corn."[25] Similarly, on April fifteenth 1810, David Hoyt commented that "spring comes fast, some people have begun to plough." To describe the season as forward or backward indicated that there was a stable sense of when the season ought to begin and that deviations from such norms posed a challenge in farming.[26] Spring could run backward as easily as it ran forward. Julius Robbins, a Deerfield farmer whose diaries spanned the 1850s and 1860s, described 1857 as a backward spring, where eighteen inches of wet snow fell on April twenty-

23 David Hoyt, Diary, 20 April 1807, American Antiquarian Society (AAS), Worcester, Mass..

24 Jonathan Hoyt, Diary, 26 December 1800, Memorial Libraries, Deerfield, Mass (ML); Abner Reed made a similar observation in his diary for January 5-22 1802.

25 David Hoyt, Diary; Discussions of a forward or backward season are not unique to the valley. Such language was used in eighteenth century England Vladimir Jancović, *Reading the Skies: A Cultural History of English Weather, 1650-1820* (Chicago: University of Chicago Press, 2001) 134.

26 David Hoyt Diary, 15 April 1807, 2 February 1810, 25 May 1812 warned of a backward spring.

first and caused the collapse of a suspension bridge across the Deerfield River. Using much the same language as David Hoyt, Robbins identified a backward spring with the slow greening of pastures and growth of the hay crop. In such seasons local stock raisers worried, in Hoyt's formulation, that they would have "no grass for cattle, nor herb for man."[27]

Despite their origins in the tumultuous breakup of the winter's ice, spring floods could create a definitively placid scene in the upheavals of springtime. When the ice thawed and the floods came, Valley diarists focused on the transformation of dry ground into a broad shallow lake. The slowing of the current as the water drifted more widely and became shallower provided a relatively placid space on either side of the torrent.[28] Diary entries mentioned sailing in the floodwaters of the spring freshet. Each time, they briefly note taking a canoe or other small craft across the meadows, sailing at leisure across normally dry ground. In contrast to the torrential flooding in the uplands, diarists described the counterintuitive placidity of lowland flooding. In 1797, the spring floods marooned Windsor, Connecticut native Thomas Robbins in Sheffield, Massachusetts and he ventured out into the meadows by canoe in the company of one of his hosts.[29] Similarly, George Howard, a diarist living in Windsor, Connecticut ventured out amid the ice floes in the Farmington during the spring thaw so that he could hunt muskrats.[30] The current in flooded meadowlands would have been gentler than in the mainstream of the river, and

27 Julius Robbins, Diary, 21 April and 3 May 1857, ML; David Hoyt, Diary, 18 May 1812.

28 White, *Organic Machine* p. 19 describes the role of friction in shaping a river's velocity

29 Thomas Robbins, *Diary of Thomas Robbins, D. D., 1796-1854* (Boston: Beacon Press, 1886) p. 30 entry for 27 March 1797.

30 George Howard, Diary, 25 February 1845, CHS; Kevin Dann described similar activities in *Lewis Creek Lost and Found* (Hanover, NH: University Press of New England, 2001).

aesthetic descriptions of floodwaters often compared it to a lake rather than a rolling stream.[31] Travel and work in floodwaters focused on their relative stillness rather than the rapidity of their flow.

Not every thaw caused flooding. When snow accumulated late in winter and then spring rains precipitated a quick thaw, the region's rivers spilled their banks onto the adjoining meadows. On the other hand, when the snow melted because of gradual warming rather than a prolonged rain event, the potential for a thaw receded into the background and flooding remained minimal. Jonathan Hoyt observed such a gradual thaw when he described "Rainy day the river rises fast today is the first rainy day since last nov'r the river has all mouldered away no breaking up this spring"[32] In this case, the absence of flooding proved more noteworthy than flooding itself.

Floodwater carried debris downstream ranging from fallen timbers to bridges and the work of clearing this drifting wood after the recession of the floods often proved to be the first step in preparing the floodplain for cultivation. Timber drifting downstream followed the eddies and whorls of the river's current out of the mainstream and into the slower-moving side channels created by the flood. In 1806, which seems to have been a typical year with relatively minimal flooding, David Hoyt collected 100 loads of floodwood from his land on the Deerfield meadows.[33] At the beginning of the century, concerns about the risks and challenges of wayward timber led to an array of legislation regulating the running of logs and also prohibiting the

31 Thomas Robbins, *Diary*, 3 March 1818; Jacob Abbott, *Marco Paul's Travels and Adventures: The Springfield Armory* (Boston: Benjamin J. Mussey, 1844)

32 Jonathan Hoyt, Diary, 4 April 1800, ML.

33 David Hoyt, Diary, 15 May 1806; Ellen Wohl, "Floodplains and Wood," *Earth-Science Reviews* 123 (August 2013): 194–212.

scavenging of marked timber in along the river's meadows.[34] While loggers thought of people taking these logs as thieves and pirates, meadow landowners treated the logs running down stream as part of their property. This represented a fundamental disagreement about how to value the work that the river did, and the work that the river failed to do. While log drivers had an obvious incentive to move their timber downstream quickly and worry about loose logs later, farmers confronted with flood wood found that the tightly timed work of plowing and planting risked serious interruption by the presence of wayward timber.

Whether or not they signaled the end of the thaw, the spring floods brought mud. They brought high water onto the meadows. They also thawed the frozen cart tracks and roads throughout the region, prompting the replacement of sleigh runners with wheels. David Hoyt observed these changes as he described the quality of the wheeling available in the spring season. While Hoyt used the language of carting weather, almost any New Englander asked about the early spring nowadays would refer to it as the mud season.[35] This evocative phrase appears to have come into use only in the early decades of the twentieth century.[36] Its first recorded use in reference to New England came in works lionizing the region's town meetings, which generally met during the March thaw when muddiness reached its greatest extent.[37] The meeting coincided with the mud because the mud reflected the last step in seasonal change before the beginning of a

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34 An Act to Secure to Owners Their Property in Masts, Spars, and Timber in Certain Cases, Mass. Laws (22 February 1794) II:610; Petition of J. Barrett and Others, 1815 Sen. Doc. 5116 Unpassed legislation, MSA.

35 Zielinski, *New England Weather*.

36 The first work applying the phrase to New England appears to be John Gould, *New England Town Meeting: Safeguard of Democracy* (Brattleboro: Stephen Day Press, 1940).

37 Rufus Saxton, "Warrant for Town Meeting" 3 March 1800, Deerfield Manuscripts IV Box 2 Folder 8 ML.

new agricultural year. It provided an opportunity to assess damages to roads, bridges, and fences during the winter and spring and encouraged the beginning of attention to repairing problems with these structures, a process that would commence in dry ground.

The recession of the floodwaters did not always signal the end of the thaw. Farmers, particularly the ones working the bottomlands of the Deerfield or Connecticut Rivers, faced challenges in the proper timing of plowing and planting relative to the floods and late frosts that threatened to kill off crops in any given year. The completion of the freshet did not eliminate the possibility of a backward spring. Almost as soon as he finished waiting for the spectacle of the spring freshet, David Hoyt began waiting for the ground to dry up so he could plow and begin planting. In February 1810, Hoyt noted the dryness of the ground describing the quality of carting rather than the quality of sleighing. Later, on March fourth of that year, he said "Today is fine and pleasant. If it were not so froze it is dry enough to plough and plant." In the late spring of 1807, he noted on 15 April that "the snow melts away very slowly. It is a very backward spring. It is about plowing time, but I believe we shall not plow this ten days."[38] Mud was an expected and ordinary part of early spring, but its presence as an obstacle late in the season, or its absence early in the season attracted a great deal of notice.[39]

The end of spring followed in the wake of apple blossoms in cultivated orchards. On 12 May 1807 David Hoyt noted that "Today is the first day of May old style and it is a fine day indeed, clear & warm & fresh…. The fathers used to say they never saw April safe away that

38 David Hoyt, Diary, 15 April 1807.

39 David Syrett, "Town-Meeting Politics in Massachusetts, 1776-1786," *The William and Mary Quarterly* 21, no. 3 (July 1, 1964): 352–66.

apple blows flew."[40] With their appearance, the role of water in shaping the seasonal landscape shifted from the release of accumulated flows generated by winter's snowfall and ice cover to episodic flows following instantaneously from rainstorms. While individual storms could prove quite dramatic, they did not carry the same uncertainties surrounding the possibility of a chain reaction, where the storm could break up accumulations of ice and snow, multiplying its potential for flooding. Thus, the end of spring meant a diminishment in the uncertainties that surrounded the weather.

Summer

> March, April and May, the three spring months for 1852, have been with us, performed their part in the cycle of seasons and are gone. That part has been rather a rough and boisterous one; now thick with weeping snows or changing into pelting hail; stinging with intense frosts, or pouring their drenching rains.
> Lovely June! Welcome with thy carpets of green, spicy gales, songs of birds and low of kine.[41]

Spring's fickle but eventful weather contrasted starkly with the relief granted by summer warmth. While the winter and early spring produced ongoing and cumulative flows across the landscape that demanded the attention of diarists, the flow of water in summer and fall proved episodic and ephemeral. The flow of water in summer did not merit the same attention in weather diaries, but this did not diminish its importance. Farmers worked in their fields to maximize the smaller volumes of water available during the growing season. They also tried to avoid harvesting crops during episodic storms. At the same time, they worked to manage the water's

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40 David Hoyt, Diary, 12 May 1807; In this entry he is adjusting his weather lore to accommodate calendar reform, about which see Poole, *Time's Alteration*.

41 "Farm Work For June" *New England Farmer* (June 1852).

cumulative flows by repairing and improving drainage and infrastructure. These practices of maintenance, which dominated farm advice literature and records of farm work, indicated the ongoing significance of managing the flow of water across the seasons.

Changes in the scientific description of the flow of water during summer corresponded with social changes in the attention paid to the flow of water in farm diaries. Summer introduced qualitative and quantitative differences in the flow of water across the landscape. Freeze-thaw cycles gave way to precipitation-evaporation cycles. Water accumulated on the landscape in subtler, less immediately visible ways, and consequently its phase changes stopped forming the basis for describing the weather. Instead, descriptions of the weather began focusing on sensible processes.[42] Diarists focused on how the weather felt because the processes by which water accumulated receded from view upon the landscape. In the summer heat, water did not generally accumulate on the ground, instead it was virtually all consumed by the evapotranspiration of plants and the replenishment of groundwater stores. Thus, summer heat transformed precipitation from a sign of seasonal change into an episodic event within the course of a season. This prompted a distinct set of responses in the assessment of weather and climate.

When focusing on the sensed qualities of the temperature rather than the flow of water shaping the landscape, many diarists did not provide narrative descriptions of the weather. While Abner Reed commented extensively on snowfall, the thaw, flooding, and mud, he paid no particular attention to the changing temperatures of the summer. Between June and August, he made no entries in his weather logs on forty-one out of ninety-two days and he made seventeen miscellaneous notes in his diary, but none of them referenced the weather. The spring proved far

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42 Strahler, *Modern Physical Geography* (New York: Wiley, 1987), p. 48-9.

more noteworthy, with sixteen of thirty-eight comments relating to the weather. Moreover, Between March and May he missed only three of ninety-two days. He also paid more careful attention to fall and winter weather, missing eight and five days respectively in those seasons, but the nature of the weather itself appeared in only two of thirty-seven remarks between September and February. References to weather consisted of notes on the snow and its absence in December 1801, the storms of January and February 1802, the muddiness of the ground in March 1801, and the floods of March and May 1801.[43] This imbalance of attention reflected a broader trend observable where many diarists did not record any entries during the summer and fall despite their careful attention to the weather in winter and spring.

Many of the farmers who assessed the qualities of water on the summer landscape did so implicitly by engaging in work that managed water rather than making direct observations about water's flow. Within diaries, a flood might attract comment, but the moisture drawn to the roots of a plant by aerating the soil with a hoe generally did not and most diarists mentioned hoeing without attributing any hydrological significance to it.[44] By contrast, at least in the 1850s, many of the advice columns described hoeing as a means of maximizing water availability in dry weather.[45] The *New England Farmer* noted that while June provided a respite to the farmer at the end of the planting season, but it also provided an opportunity to get ahead of the weeding and hoeing that maximized water availability for crops. In the eyes of agricultural reporters, hoeing

43 Reed, Diary, similar patterns occur in Ira Lindsey, Diaries, AAS; Levi Stockbridge, Diary, University of Massachusetts Special Collections and University Archives, Amherst.

44 Stephan Buczacki, *Understanding Your Garden: The Science and Practice of Successful Gardening* (Cambridge : Cambridge University Press, 1990) p. 48; Reed, Diary, 10 June-6 July 1801; Jonathan Hoyt, Diary, 10 June 1805.

45 “Farm Work for June” *New England Farmer* 4 no. 6 (June 1852): 249; “Calendar for June” ibid. 7 no. 6 (June 1855): 249; “Calendar for June” ibid. 10 no. 6 (June 1858): 249;

provided a means of ensuring that plants acquired their full share of soil moisture from the morning dew. In the transition from spring to summer, farmers in New England shifted their attention from watching floodwaters to scratching the earth for a marginal improvement in soil moisture.[46] This was not the only reason to hoe, but it did appear regularly in farm advice. Although the flow of water played a secondary role behind temperature in weather diary entries describing the summer, the work farmers carried out upon the landscape reshaped the flow of water.

When water did not accumulate on and run off the landscape regularly, the seasons did not attract attention for running forward or backward. The significance of this observation can be seen on David Hoyt's farm, where the pace of work and attention to the weather shifted during summer and fall. The growing season depended on alternation between days of rain and sunlight, but the order in which sun and rain alternated did not matter terribly much. While Monday might not prove a good hay day, the next several days might provide an opportunity to mow. Consequently, he never made any reference to summer being forward or backward because of extremes in precipitation or dryness. The winter and spring were organized around snowfall and snowmelt, but summer remained summer whether or not the sun shined. Ironically, the ephemeral place of water on the landscape contributed to a stronger sense of permanence and settledness in the season itself. Looking across the water year, the freeze-thaw cycles of winter and spring had distinct hydrological consequences relative to the periods of drought and precipitation during the summer where the alternation between rain and sun had no set order.

46 Ibid; Interestingly, the articles on work for June during the 1830s, particularly the column "Farmers' Work for June" Ibid (June 1831) and (June 1835) each addressed questions about stock keeping. During the 1850s, these columns paid increasing attention to the work of the fields, particularly practices such as hoeing.

Even if there was no sense of summer being forward or backward, farm periodicals still imposed an order on the season's work. Seasonal advice covering the summer provided what were essentially to-do lists peppered with reflections on the sensibilities that governed weather in a typical instance of an individual month. These editorials generally addressed hoeing in June, haying in July, and the management of manure and water-supply systems in August.[47] These articles often mixed romantic accounts of the weather with practical advice on farm improvement, both of which drew upon observations of English farming practices as much as they drew upon the local experiences of New England editors. While this provided an imperfect map of a farmer's responsibilities—hoeing and haying depended on the particulars of weather on particular days, not on the calendar month—tracing these responsibilities across the three summer months provides an opportunity to understand their succession and relationship to the broader seasonal patterns governing water. Splitting these tasks across the summer reflected attention to the variations in soil moisture and water availability at a small scale within individual fields, as well as from day to day. This intensification of attention to declining quantities of water over the summer season reflected the changing stakes of different flows.

The efforts that farmers put into ordering the landscape to deal with declining volumes of water during the summer served to intensify problems when rain did fall. While the spring floods made a resounding statement about how water shaped the landscape, summer dew or a brief rain shower could play just as significant a role in determining the quality of the harvest. Unexpected

47 "A Calendar for June" *New England Farmer* 7 no. 6 (June 1855):256; "Calendar for July" ibid. 6 no. 7 (July 1854):297; "Howit's Book of the Seasons: July" Reprinted in *New England Farmer and Horticultural Register* 13 no. 1 (July 1835):2; "Farmer's Work for August" ibid. 14 no. 6 (August 1836): 46; "Seasonable Suggestions" *New England Farmer* 8 no. 8 (August 1856):345.

storms in summer could cause significant damage. Flooding that was mild compared to the spring interrupted cultivation and ruined crops. Early summer floods, rare though they were, threatened to drown hay and row crops, slow growth and introduce molds. A June, 1805 storm left the corn in one of David Hoyt's riverside fields looking "weak, feeble, and sallow" while leaving the ground on the Deerfield Meadow "so wet there is no hoeing" and resulted in bad mowing through the remainder of the first hay season.[48] The year would not prove a total loss, as the Hoyts mowed the second growth of hay in September, but it did reflect the difficulty of dealing with unexpected variations in the flow of water. In contrast with spring floods, which farmers knew to anticipate even if they did not know when they would occur, summer floods were both unpredictable and unexpected.

In some seasons, summer low water extended into a drought or unexpected rains brought flooding. David Hoyt described a visit to his pastures in August 1804 during a dry spell that left grass "burned up, but the cattle all alive" in the home meadow and the "grass dryed [sic] up [so] that the cattle cannot live there" in his upland pasture.[49] Hoyt expected his upland plantings to feel the pinch during drought, but that these crops would see him through unusually rainy summers.[50] In 1809, Hoyt described a storm that brought ten days of rain to the Deerfield Valley, drawing the river out into the meadows, ruining the year's first hay crop and interrupting the hilling of corn. He appears to have dealt with this setback by relying on crops planted elsewhere

48 David Hoyt, Diary, 9-11 June 1805, 17 July 1809; George Chapman, Diary 23-29 August 1843; Jeremy Hoadley, Diary, 23-29 August 1843, item 36119 CHS.

49 Idem., Diary, 29 August, 3 September 1804.

50 Brian Donahue, *The Great Meadow: Farmers and the Land in Colonial Concord* (New Haven: Yale University Press, 2004); J. Ritchie Garrison, *Landscape and Material Life in Franklin County, Massachusetts, 1770-1860* (Knoxville: University of Tennessee Press, 1991)..

in the town, particularly on Dublin pasture, where much of his rye crop would be harvested successfully in the following weeks. By spreading cultivation across different patches of landscape in different parts of the town, the Hoyts avoided the potentially disastrous consequences of both small scale weather events and year to year extremes.[51]

The absence of water structured the work of the farm when it came time to mow hay or hoe corn during the spring and fall. The work of haying depended on the avoidance of moisture and this depended on a farmer's timing. The day's labor in haying needed to begin in the morning so that the cut grass could dry into the afternoon, but at the same time, the hay required elevation into haycocks—round stacks of cut hay drying or curing. A good hay day depended on the absence of moisture to minimize the decomposition process in curing hay.[52]The significance of hay days magnifies in light of the potential damage caused by summer rainstorms occurring in the midst of haying.[53] Such storms occurred through the Connecticut Valley floodplain on a regular basis even if they did not cause noteworthy flooding. When Levi Stockbridge, a Hadley, Massachusetts farmer, experienced a surprising summer storm, he noted "this afternoon secured one load of hay & had two more dry and ready for carting, but a shower came suddenly, and caught us (as haymakers say) in the suds."[54] The risk posed by rain during the haying season extended beyond the tendency of a storm to chase farmers from their fields, storing wet hay created a danger of spontaneous combustion because its tight packing created anaerobic

51 David Hoyt, Diary.

52 References to hay days include Jonathan Hoyt, Diary 18,19 June 1805; Julius Robbins, Diary 20 June 1856; Ira Lindsey, Diary, 6 July 1858, 7 July 1859, 7 July 1860, 27 June 1861, 17 July 1863, 6 July 1865, 10-20 July 1866, 2,10 July 1868, 19 July 1869; David Hoyt, Diary,

53 Strahler, *Modern Physical Geography*

54 Stockbridge, Diary, 31 July 1844; David Hoyt, Diary, 12-13 June 1804;

conditions similar to a compost pile.[55] Although haystack fires, and even barn fires, do not feature in any of the diaries consulted, advice on managing the temperature of hay stacks appears in farm journals. The absence of fire likely reflected prudent planning around the problem of haying during the rain rather than mere luck. Like the design of villages in the Connecticut Valley at the edge of the floodplain, the harvesting practices that defined summers in the Valley worked around the local danger, in this case the risk of hay combustion.

During the dry weather of summer farmers to paid attention to long periods of dry weather punctuated by brief and episodic storms. Because of the increased intensity of evaporation and transpiration drawing water out of the environment, the cumulative flows that had defined the winter and spring came to an end. This increased the level of detail at which farmers approached water management, particularly in thinking about how actions such as hoeing might shape water availability, but also the possibility of of a storm remained prominent in the minds of valley residents. Awareness of the possibility of rain and storms did not make it possible to prevent or even adapt to flooding, rather, the possibility of a summer flood destroying the season's crop loomed over valley residents throughout the season.

Fall

> August is that debatable ground of the year, which is situated exactly upon the confines of Summer and Autumn; and it is difficult to say which has the better claim to it. It is

55 Steve Fransen and Ned Zaugg," Spontaneous Combustion of Hay" Washington State University Extension Service ext.wsu.edu/hay-combustion.html accessed 11 March 2015. Although perhaps not well known in the valley, the problem of spontaneous hay combustion was known during the early nineteenth century, see W. Tooke, "Observations on Spontaneous inflammation With a Particular Account of That Which Happened on Board a Russian Frigate in the Year 1781" *Annual Register* 37 (1793): 76.

dressed in half the flowers of the one, and half the fruits of the other, and it has a sky and temperature all its own.[56]

The shift from late summer into fall proved a gradual one, unmarked by a defining hydrological event similar to the spring thaw or the hard frosts of winter. The work of August and September, two months at the center of this debatable ground, ranged from harvesting produce to excavating and repairing drainage tiles. Although the lack of a defining hydrologic event obscured the boundary between summer and fall, this season helped to determine the events of the upcoming water year because it stood out as a popular time for maintaining and redesigning water management infrastructure. Like the summertime work of planting and mowing, the work of fall did not follow a tightly set schedule, but instead presented farmers with a shifting list of priorities that they needed to balance throughout the season. Tropical storms and hurricanes could interrupt the pursuit of these goals when they passed through the Connecticut River Valley—an event that occurred roughly once every ten years, but these only temporarily interrupted the ordinary processes of water management during the fall and their significance lay in how they revealed the work that depended on an absence of floodwaters. Even when such events did occur, the farmers under consideration in this chapter understood them as processes local to their home watersheds rather than weather systems that spanned the hemisphere and fit within a broader storm season.

The dry weather from August to November provided an opportunity to maintain and rebuild household and farm water management systems.[57] Farm advice encouraged the division

56 Peter Patmore quoted in “Seasonable Suggestions” *New England Farmer* 8 no. 8 (August 1856).

57 Holland Montague, Diary, 29 August-12 October 1857 and 18 August-23 August 1858, Umass; Julius Robbins, Diary, 13 November 1858.

of attention between the harvest and reengineering the flow of water across the landscape. The opportunities pursued in the dry soil of August varied as the years wore on. Although the tasks of the farm varied little, new technologies for water management introduced piped water, and this presented new challenges in the design and maintenance of water systems. Farm advice columns during the 1830s focused on designing manure piles and barnyards with attention so that drainage would carry the maximum amount of waste to a central single compost pile. Their successors in the 1840s and 1850s paid more attention to the development of cisterns, pumps and reservoirs for the collection of rainwater, its submersion below the frost line, the insulation of pumping machinery against frost, and the use of this newly acquired water to keep stock hydrated during the winter.[58] Importantly, however, the work of reshaping farmyard drainage in the 1830s and relining ditches and pipes in the 1850s reflected a common awareness that having water flow as expected through winter, spring, and summer depended on the maintenance of the landscape during the fall.

Whether they were regrading drainage, rebuilding cisterns, fixing leaky pipes, clearing ditches, or insulating pumps, the work of maintaining water management infrastructure helped to overcome the processes of decay. Thus, we might view the communities and farmsteads of the Early Republic as places with continuous access to water, their ability to access such water depended on an ongoing struggle to prevent change. Historical archaeologists are fond of reminding us that the soil beneath the valley landscape is littered with the remains of bygone

58 "Seasonable Suggestions" *New England Farmer* (August 1856): 345-6; "Swamps—Draining" Ibid. (August 1853): 350; "Farmers' Work for August" Ibid. (August 1835): 46; "Farmer's Work" Ibid. (August 1834): 46; "Farmer's Work for August: Farm Yard, Manure, Etc." Ibid. (August 1832):30; "Farmer's Work for July and August" Ibid. (July 1831):14; "Farmer's Calendar" Ibid. (August 1825):14.

drainage systems and water pipes.[59] Within the archives, a diverse array of aqueduct company records tell a similar story. Without the continual work of maintenance, any drainage system would overflow, remaking the landscape anew. Seasonal variations in weather and the flow of water thus determined the landscape of settlement and the character of maintenance necessary to keep that landscape of settlement in operation as a human community. Consequently, the work of maintenance also created the landscape of the Connecticut River Valley during the nineteenth century, and its seasonal cycles reinforced a process vital to the life of the community.[60]

The fall also saw an uptick in stormy weather. While tropical storms typically form in the South Atlantic between August and November, the nor'easter compounded the threat of storms at the end of hurricane season. Each of these regular, but episodic precipitation events threatened to interrupt work, flood fields before the completion of the harvest, and upend the season more generally. The increasing volume of flooding in October and November testified to the coincidence of these two powerful storm formation systems. Seventy-four percent of flooding occurred in the spring between March and May. Fall flooding occurred once a decade, if not annually, with eighteen floods—or thirteen percent of floods recorded occurring between September and November.[61] These floods occurred roughly decadally between 1839 and 2009.

59 Robert Paynter, "Time in the Valley"

60 Stockbridge, Diary, 15 November 1842, described cutting logs for a watercourse; Ira Lindsey, Diary, 30 September 1865, 6 September 1866, 21 September 1866, 6 November 1866, 15-17 September 1868, 6 October 1868; Julius Robbins, Diary, 16-30 November 1862, 1 May 1862.

61 This data comes from NOAA Advanced Hydrologic Prediction Service http://water.weather.gov/ahps2/crests.php?wfo=box&gage=hfdc3&crest_type=historic. It is discussed in greater depth in chapter six.

Unlike spring freshets one flood event gave few clues as to when the next flood event might happen, but several such floods could be expected within an individual's lifespan.[62]

Diarists keeping track of flooding between June and September described it as a function of localized extreme rain events rather than thinking of them as storms with tropical origins.[63] Indeed, the only passing reference to tropical weather patterns in these diaries described a January 1839 storm passing over Hartford, Connecticut, whose "sharp winds blew a hurricane."[64] By calling the winds of a winter storm a hurricane Jeremy Hoadley—a haberdasher who lived along Hartford's Little River, a Connecticut tributary—indicated his familiarity with tropical weather patterns, but no awareness of the relationship between these patterns and weather in the Connecticut River Valley. Hoadley thought about tropical storms as weather patterns connected to New England only metaphorically. This reflected the broader focus of New England weather diarists on understanding the climate through its local context rather than its place on the globe.

The focus on the local extended from diarists attention to the origins of storms to their descriptions of the aftermath of these storms. Levi Stockbridge, in an 1843 diary entry on the aftermath of an October storm, noted that "the river is literally filled with corn, pumpkins, apples, rafts of timber broken and torn to pieces, shingles, boards, trees torn up by the roots, &

62 Robert E. Davis et al. "Synoptic Climatology of Atlantic Coast North-Easters" *International Journal of Climatology* 13 no. 2 (March 1993): 171-90; Idem. and Robert Dolan, "Nor'easters," *American Scientist* 81, no. 5 (September 1, 1993): 428–39..

63 "From the Northampton Gazette" *Connecticut Courant* 15 September 1828; Chapman and Hoadley Diaries 20-23 August 1843 describe a similar storm; James Fleming, *Meteorology in America, 1800-1870* (Baltimore: Johns Hopkins University Press, 1990); David Ludlum, *Early American Hurricanes* (Boston: American Meteorological Society Press, 1963).

64 Hoadley, Diary, 26 January 1839.

wood beyond calculation. The rise of the water is so unexpected, the damage upcountry is great."[65] When diarists and newspaper reports made flood damage central to their descriptions of extreme rain events in the fall, they revealed two important elements of their seasonal attitude toward the landscape. They presented precipitation as a local and episodic process connected with the transformation of how water flowed across the landscape. At the same time, the shocks of wheat, stacks of hay, rafts of lumber, and arrays of row crops floating in the floodwaters indicated that ordinary agricultural work depended on the assumption that the floodplain would not flood out of season. In this sense, while fall flooding was not outside the range of known natural phenomena, it did not mark an element of the cumulative, and therefore predictable, weather. Reports of fall floods reveal a moment where the flow of water defied expectations and exposed what residents of the valley took for granted in assessing the landscape.

The end of fall loomed over the work of the season because the frost imposed a firm deadline on both the harvest and the adjustment of water management infrastructure. The author of an 1862 column about digging potatoes in November lamented his father's procrastination until "the soil was pretty well frozen, and when a cold, piercing wind blew most uncomfortably all day long. With strong hoes the crust of frozen earth was broken and tipped off the hills, while with mittened, benumbed fingers we gathered the potatoes from their beds and from the crust into which many of the upper ones were frozen."[66] Frederick Gleason noted a similar problem in his own fields on 20 October 1854—a day where the temperature dipped to twenty-five degrees at four in the morning—that "tomatoes, dahlias, grape vines too, have before this been untouched

65 Stockbridge, Diary, 9 October 1843; another similar instance appears in "Freshet" *Connecticut Courant* 16 September 1828.

66 "Thoughts About November" *New England Farmer* 14 no. 11 (November 1862): 489.

in the garden."[67] Meeting the deadline of frost meant profiting from the year's work in the fields, and missing them entailed taking a loss. Diary entries referencing frost between the middle and the end of fall reflected a moment in the seasonal process where close attention to how the weather felt and working practices grounded in the absence of water gave way to cumulative forms of weather that began when the freeze-thaw cycle restarted.

Winter

> In many cases, the first considerable snow will in a forested country become the commencement of winter; when, if the same country were generally open, the same snow would be wholly dissolved by the immediate action of the sun, and the winter in the appropriate sense would commence at a later period.[68]

The key phrase in Timothy Dwight's quote, above and throughout this section is "winter in the appropriate sense." Winter meant snow cover in Timothy Dwight's picture of the New England climate. It began with the first snow and continued through the spring thaw. In this picture, snow moved farmers from their fields up into their woodlots where they carried out many of the tasks of lumbering that fueled home heating and cooking. At the same time, snow cover sped transportation, enabling the replacement of carts with sleighs, and encouraged visiting and sociability.[69] While cultivating crops required precisely timed attention to work, cordwood needed seasoning in the open air before its use, giving the process of gathering firewood a time

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67 Frederick Gleason Diary 20 October 1854 CHS.

68 Dwight, *Travels in New England and New York* (New Haven: Timothy Dwight Jr., 1821) 1:40.

69 Karen V. Hansen, *A Very Social Time: Crafting Community in Antebellum New England* (Berkeley: University of California Press, 1994).

horizon of six months to one year rather than the weeks and days that delimited farm tasks.[70] In this sense, although the snow and ice of winter accumulated, the work of the winter remained an episodic task, prioritized in ideal weather, but not facing the same cumulative, temporally sensitive challenges that existed in the spring. When the winter met these expectations for snowiness, its landscape was an ideal space for sociability and unhurried work.

Winter almost never provided continuous snow cover. The weather warmed and the ice thawed regularly in diarists' accounts of winter. Periodically throughout the winter, snow melted and mud bedecked the landscape. While snow cover dominated the memory of winter, this process of freezing and thaw set the rhythm of sociability and work across New England. Amidst light snows, reports of warm weather and the ephemerality of snow abound in the diaries, which typically described periods where poor carting, or the end of sleighing slowed down travel. This added volatility carried with it regular laments about the ephemerality of snow and the inconvenience of the mud revealed when it melted.

When confronted with heavy snows, the prospect of a thaw changed dramatically. The severity of snowfall foreshadowed the eventual severity of the thaw. Heavy snowfall meant that the next thaw could bring high rivers, and deep mud. If that thaw occurred because of rainfall, it could also break up the ice on the river, creating the possibility of ice jam formation.[71] Across twenty-two winters described in diaries, the river thawed four times in December, eight times in

70 Ceylon Monroe, "The Art and Science of Stacking Firewood," *Mother Earth News* (October/November 1994) http://www.motherearthnews.com/homesteading-and-livestock/stacking-wood-zmaz94onzraw.aspx?PageId=1

71 An analysis of ice jam formation appears in Spyros Beltaos, "Advances in River Ice Hydrology," *Hydrological Processes* 14, no. 9 (June 30, 2000): 1613–25.

January, eleven times in February, and three times in early March, before the last snowfall. At least one midwinter thaw occurred in any given year.[72]

As winter wore on, the accumulation of snow and its cycles of melting, refreezing, and replenishment in new storms attracted regular notice. It was these small-scale patterns of snowfall, melt, and refreezing that dominated diary accounts of winter in the Connecticut River Valley. People living and working around bridges in the valley paid avid attention to the quality of ice in this area. Jonathan Hoyt, who operated a toll bridge on the Deerfield River, paid close attention to this process in part because the rotting of the ice on the river meant increased revenue as prudent travelers began traveling on the bridge rather than crossing on the ice. Decades later George Chapman commuted across the bridge from East Hartford to his tailor shop, which neighbored the toll house on the Hartford side. During breaks from work he got a clear view of the efforts that East Hartford residents—some of whom had their own complaints about the operation of the bridge—at maintaining a path of ice across the stream. He noted a string of incidents where teams crossing the river in January and February misjudged the depth of the ice and plunged into the water.[73]

Warm spells in the midst of winter attracted particular attention. A gap in snowfall led Reed to observe of January 1802 that "the winter thus far to the end of this month has been remarkably moderate and the ground entirely bare except once or twice a little flurry of snow

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72 David Hoyt, 7 Diaries between, 1804-1814; Lindsey, 9 Diaries, 1861-1869; Edward Carpenter, 1 Diary, 1844-5; Abner Reed, 1 Diary, 1801; Jonathan Hoyt 2 Diaries 1800, 1805; George Chapman, 1 Diary 1845.

73 Chapman, Diary, 25 February 1845, 17 February 1842, 14 February 1858, 2 March 1842, 16 December 1842, 19 December 1842, 26 January 1846, 20 February 1842, 2 February 1846, 22 December 1842, 24 December 1842; Jonathan Hoyt Diary, 15 February 1800, 15 December 1800.

that whitened the ground some. This month in particular has been…very warm and springlike, as much as usual in April."[74] Jonathan Hoyt observed similar weather at Deerfield on December twenty-fourth 1800, when the day started as "warm as a May morning about ten o' clock it clear off fair and pleasant it looks like plowing time."[75] Hoyt also recorded that the livestock had been released back onto Deerfield meadows during that warm December. While there could be benefits, Hoyt and Reed both assumed that December should be snowy and that this should inaugurate the season as a whole, leading to surprise and even a little disappointment when the weather remained warm.[76] The concern for the condition of the ground suggested by Dwight and developed in the diaries of Hoyt and Reed reflected the contrasting types of work that could be completed depending on the condition of the ground. Muddy ground augured poor carting, which would make it impossible to sled loads of wood. Such weather left David Hoyt sledding his first loads of wood during an extreme cold snap during February 1810 after an unseasonably mild January.[77]

Sleighing weather was not something that residents of New England could take for granted. It depended on snow that was deep, but not too deep, and temperatures that were cold, but not too cold.[78] Even the snow prompted careful attention to its qualities as plans to travel by sleigh depended on powdery snow falling in particularly cold weather without excessive accumulation. One letter writer described a trip from Farmington to Hadley taking less than a

74 Reed, Diary, 5-22 January 1802.

75 Jonathan Hoyt, Diary, 24 December 1800, but see also December 3-23.

76 Benjamin Orlove, "How People Name Seasons" in *Weather, Climate, Culture* Orlove and Sarah Strauss eds. (New York: Berg, 2003) 121-140.

77 David Hoyt, Diary, 2 February 1810.

78 "Farm Work for the Autumn" *New England Farmer* 12 no 10 (October 1860): 483.

day because of “a fine snow of sufficient depth to make the best of sleighing” but several years later complained of delays in traveling from Middletown upriver to Hadley because the snowfall had been relatively warm and loosely packed, making for poor sleighing.[79] The accumulation of precipitation provided a means of assessing transportation options. At the same time, sustained cold weather allowed ice to build up on the rivers, rendering them passable for great distances. During the winter of 1810, Hoyt noted the river’s possibility from Hanover, New Hampshire to Saybrook, Connecticut, a distance of more than two hundred miles.

It would not be unusual for these wintertime breakups on the river to produce ice jams that obstructed the downstream flow of water and caused flooding on the meadows and threatened the stability of bridges.[80] Jonathan Hoyt’s uncle spent March eighth 1805 buttressing the supports for the Deerfield River Bridge in Deerfield seeking to prepare the structure for the thaw. Such a concern for ice jams continued through the nineteenth century, with the bridge being destroyed in floods in 1806 and later in winter 1830.[81] In diaries, these midwinter thaws came and went with brief mentions of the end of sleighing and the water spread onto the meadows, and occasionally a mention that the ground looked like spring, but only a particularly favored—or reckless—farmer would begin to plow during an early thaw. At the same time, travelers faced a variety of challenges regarding the judgment of ice depth. The thaw proved a challenge for travelers across the region. Much like the teams that George Chapman observed

79 Elizabeth Whiting Phelps Huntington (EWPH) to Elizabeth Porter Phelps, Box 13 Folder 2 EWPH Correspondence, Porter Phelps Huntington Papers, Amherst College Special Collections, Amherst, Massachusetts.

80 Jonathan Hoyt 15 December 1800, 15 February 1800; Reed, Diary, 10 February 1799 George Chapman, Diary, 3 February 1839, 4 March 1841.

81 “Petition of Asa Stebbins et al. Proprietors of Deerfield Bridge.” 1830 Senate 8922-1, Unpassed legislation, MSA.

being lost in crossing the Connecticut, records of flooding in early nineteenth-century winters regularly noted injuries and deaths by travelers during the thaw. Riders who misjudged the thickness of the ice fell through and sometimes lost their lives during late winter floods.

Conclusion

The water year provided a key to understanding seasonal change as it guided labor on the landscape during the early nineteenth-century Connecticut River Valley. While it may be typical to think of landscapes as singular objects in space, residents of the Connecticut River Valley paid particular attention to transitions in seasonal landscapes. In this, they did not always look for the most noteworthy or stunning indicator of seasonal processes, but instead they paid attention to water as a singular indicator of the seasonal change. Where work was concerned, the valley consisted of four landscapes, the plowable landscape, the hoeable landscape, the harvestable landscape, and the frozen landscape. The possible forms of work that the landscape presented defined everyday life within the valley, and the identification of these possible forms of work depended on observations of the flow of water. Water's phase changes provided a heuristic tool for understanding how the conditions of the landscape would shape the working day. The flow of water provided a crude but effective weather instrument and a way of connecting the condition of the ground with working practices throughout the year. These observations proved important because they connected the temporality of the landscape, specifically its changes throughout the year, with how people conceptualized the possibilities for work upon the landscape.

In this sense, the flow of water provided an indicator of seasonal change, albeit a pedestrian one, which is generally overshadowed by weather lore in histories that touch upon seasonality. In contrast with weather lore, it was in the very pedestrianness of the flow of water that its usefulness lay. Flows recurred across seasons.[82] They depended not just on the organization of the landscape, but also on the processes that created opportunities for cultivation and harvest. Paying attention to water—regardless of whether it was manifested in soil moisture or river flow—provided a ubiquitous and easily described indicator of seasonal change. The flow of water followed annual patterns—particularly the overwhelming prevalence of spring flooding and dry summers—and this made it possible, and even necessary, to arrange working practices around the seasons. This provided a level of continuity at the bedrock of farm life in the Connecticut River Valley. Water's flow made the weather predictable at a scale of days and weeks, providing opportunities to plan and adapt to the specific conditions created during a given year.

Going forward, one of the key questions in this dissertation will be how the predicability of water's flow shaped responses to proposals for river engineering. The content of petitions against new river channels, bridges, and dams regularly referenced the severity of spring flooding in arguments against engineering the river. This resulted from an understanding of how river engineering projects interfered with the timing of cultivation. Because the predictability of water's flow shaped farm management as both a physical tool readying the land for cultivation and as a heuristic tool for identifying the readiness of the land for cultivation, it became possible to make the flow of water an object of politics.

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82 The corn story appears in James C Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, Yale Agrarian Studies (New Haven: Yale University Press, 1998); William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1983); Carolyn Merchant, *Ecological Revolutions: Nature, Gender, and Science in New England* (Chapel Hill: University of North Carolina Press, 1989); Eric Sloane, *Folklore of American Weather*, (New York: Duell, Sloan and Pearce, 1963).

Chapter Two:
Erosion and Deposition:
Geological Knowledge and Social Change in the Connecticut Valley, 1790-1815

> "Because we are unable directly to sense slow changes and because we are even more limited in our abilities to interpret their cause-and-effect relations, processes acting over decades are hidden and reside in what I call 'the invisible present.'"[1]

This chapter argues that the "invisible present" becomes evident in the ways that farmers in the nineteenth-century Connecticut River Valley understood how landscape changes that had occurred in deep time shaped their day-to-day labor. The invisible present is, then, a social artifact and historical approaches to talking about the landscape tell a different story about how people lived and worked within the echoes of geological change. Farmers working on the fertile lowlands of the Connecticut River floodplain regularly observed both gradual and dramatic changes in the river's course. They also understood that the landscape of the floodplain had formerly been a lakebed. This understanding of how the landscape changed over deep time informed their criticism of proposals to intervene in the river's course and change it in historical time.[2]

This chapter considers geological processes alongside seasonal weather patterns as factors that guided observations of the landscape. The previous chapter discussed how processes

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1 John J. Magnuson, "Long-Term Ecological Research and the Invisible Present," *BioScience* 40, no. 7 (1990): 495.

2John Urry, "How Societies Remember the Past," *The Sociological Review* 43, no. S1 (May 1, 1995): 45–65; Phil Macnaghten and idem., *Contested Natures* (Thousand Oaks, Calif: Sage Publications, 1998); Gary J. Brierley and Kirstie A. Fryirs, *Geomorphology and River Management: Applications of the River Styles Framework* (Malden, Mass.: Blackwell, 2005).

of seasonal change formed a core element of how farming communities understood their world, exploring how the river's significance as both a force shaping the character of the landscape and as a heuristic tool for understanding the possible forms of work upon that landscape. The current chapter discusses how communities in the Connecticut River Valley explained the geological processes that continued to shape the river and its floodplain during the Early Republic. While valley farmers could not imagine the ice ages that are now seen as a key factor in shaping valley geomorphology, they did understand that it changed on a geological timescale that dwarfed their lifespans. To situate this baseline knowledge of geological change, this chapter explores how Timothy Dwight—President of Yale College, Federalist political leader, and leading geographer of New England—depended on accounts of ordinary farmers working with land as he developed an understanding of its changing geology. Dwight interpreted geological change with the help of conversations with local farmers, who filled in the details of the landscape for which he had a big picture. The chapter then situates the political significance of geological knowledge by turning to the proprietors of the Agawam Meadows—part of a small farming village in the town of West Springfield—who described the river’s geology when responding to proposals to reengineer its flow. The first section emphasizes how the changing flow of the river fit within broad descriptions of the landscape during the Early Republic. The second emphasizes the political implications of this outlook, as it exacted costs against some landowners while apportioning benefits to neighboring landowners.

Dwight's accounts of the landscape provide evidence of how his informants described that landscape, a process that historians of science describe as infrastructure inversion.[3] Instead of reading Dwight's *Travels in New England and New York* with an eye toward what he says about the landscape itself, it asks how Dwight learned about the character of the landscape and explores how this process of inquiry shaped his work. Dwight relied on residents' descriptions of the valley's deep history that had been gleaned from working the landscape and were subsequently deployed in debates over how reengineering or reshaping that landscape might affect the river's flow. In other contexts, this way of knowing the natural world has been described as democratic science because the scientific discourse depended on characterizations of the landscape provided by ordinary people.[4] The historian of science, Andrew Lewis described democratic science as a method that depended on the authority of eyewitnesses and valued quantities of testimony over the qualities of experimental design. In the Connecticut River Valley, democratic science did not simply denote the connections between lay and expert knowledge, it also denoted how ordinary people deployed scientific knowledge in debates over how to use water in shaping the landscape. Thus, ordinary ways of knowing gained a measure of authority in scientific accounts of the landscape—democratizing an elite way of knowing—while

3 Ashley Carse, *Beyond the Big Ditch: Politics, Ecology, and Infrastructure at the Panama Canal* (Cambridge: MIT Press, 2014); Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, Mass: MIT Press, 2010); Geoffrey C. Bowker, *Science on the Run: Information Management and Industrial Geophysics at Schlumberger, 1920-1940* (Cambridge, Mass: MIT Press, 1994).

4 Andrew J. Lewis, *A Democracy of Facts: Natural History in the Early Republic*, (Philadelphia: University of Pennsylvania Press, 2011); A British example of popular participation in science appears in Anne Secord, "Science in the Pub: Artisan Botanists in Early Nineteenth-Century Lancashire," *History of Science* 32 (September 1, 1994): 269–315; Benjamin R. Cohen, *Notes from the Ground: Science, Soil, and Society in the American Countryside* (New Haven: Yale, 2009).

simultaneously shaping the politics of water use—adding political power to the retinue of characteristics underlying democratic science. This resulted, in part, from the fact that during the Early Republic elite forms of authority were eroding while the credentialed expertise of engineers had yet to be developed. Democratic science thrived in this lacuna and gave the towns of the Connecticut Valley new forms of power in their protests against landscape changes.

When town meetings petitioned against the modification of a river channel, they were not simply defending what they saw as a natural process against engineering interventions. Farmers who represented the existing course of the river as the optimal course benefitted from ditches and drains dating back to the conquest and settlement of the valley in the seventeenth century.[5] Much like the networks of irrigation canals described by Mark Fiege in *Irrigated Eden*, these ditches and drains contributed to geomorphic change during the course of the nineteenth century, but valley farmers represented them as elements of the natural world unlike proposed innovations in water management.[6] While this may seem to represent a contradiction between natural features of the landscape and human efforts at shaping the landscape, this distinction did not hold for many valley communities. They did not distinguish between geomorphic change and engineered change, but rather they distinguished between work that furthered providence and work that contravened its blessings. Improvements to the landscape might have made them participants in the process of geomorphic change, but they did not emphasize this point when they portrayed their practices following the agency of nature rather than acting as agents of their own visions.

5 Henry Burt, *The First Century of the History of Springfield From its Original Records* (Springfield, Mass.: published by the author, 1895);

6 Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (Seattle: University of Washington Press, 1999).

Thus, the question of whether straightening the river channel could survive annual floods was answered using evidence gathered by observing changes in the river's flow over decades and centuries. These proposals generally envisioned damming off of old channels while excavating new ones. While people generally believed that the river might scour a new bed during its ordinary flow, the main question driving their skepticism about reengineering the river was whether a new channel would be able to accommodate floodwaters, or whether the old channel would be able to drain itself if the river did overflow the dam separating it from the old channel. The work of water management, arising from efforts at maintenance and the entrenchment of a stable landscape blended in with the development of new infrastructure. Communities debated where to draw the line between new developments that reengineered the landscape and historic land management practices that maintained continuities in water's flow.

Timothy Dwight's View of the Landscape

There is no small irony in putting Timothy Dwight at the center of a narrative about landscape analysis and democratic science. Variously described as a Federalist Pope or a Moral Legislator, historians remember Dwight as a holdover from the colonial elite who found his way into the center of Connecticut's conservative politics during his presidency at Yale.[7] Born in 1752, he had grown up in Northampton, Massachusetts, the favorite grandson of minister Jonathan Edwards and reputed to be something of an educational prodigy. Dwight grew up in the valley, leaving for his education at Yale. During the course of his education, a bout of the

7 John R. Fitzmier, *New England's Moral Legislator: Timothy Dwight, 1752-1817*, (Bloomington: Indiana University Press, 1998); Robert J. Imholt, "Timothy Dwight, Federalist Pope of Connecticut," *The New England Quarterly* 73, no. 3 (September 1, 2000): 386–411; Edmund S. Morgan, "Ezra Stiles and Timothy Dwight," *Proceedings of the Massachusetts Historical Society*, Third Series, 72 (October 1, 1957): 101–17.

smallpox left him farsighted, making this precocious reader unable to carry out studies for extended periods of time. He returned to Northampton, farming his father's land for two years as he worked to settle the family estate before taking up the ministry at Fairfield, Connecticut. When Dwight took up the presidency of Yale in 1795, he quickly realized that the stresses of administrative work threatened to worsen his health, particularly his eyesight, and he embarked upon a string of journeys through New England and New York to rejuvenate and reenergize himself for work. These journeys are at the heart of his *Travels in New England and New York* and they provided one of the most reliable accounts of the landscape in the northeastern United States between 1796 and 1815.

Dwight did not have a democratic cast of mind, and he almost certainly understood his teaching as an act of raining down religious knowledge into the fertile minds of his students rather than engaging in a more cooperative and interactive form of education. His ministerial authority did not, however, blind him to the potential of vernacular accounts of the landscape. In part, this resulted from the fact that there were no alternative means of gaining an understanding of the lay of the land. In part, it resulted from the confidence that came with a sense of common purpose between Dwight as an elite figure in Early Republican New England and the ordinary people who lived and worked in New England towns.

While the *Travels* represented one of the most comprehensive accounts of landscape and society in the Early Republic, it was by no means the only such account. Jedediah Morse wrote a popular series of geographical works while serving as the minister of Charlestown, Massachusetts, and new institutions such as the Massachusetts Historical Society and the Connecticut Academy of Arts and Sciences engaged in extensive correspondence to learn geographical facts about the towns and cities of New England.[8] These surveys provided a means of studying data ranging from mortality statistics to landscape improvements. All of these sources shared a preoccupation with the township itself as a geographical unit for understanding the landscape. The informants used in these works, like the informants who talked to Dwight, could provide detailed analyses of the soil to a hundred feet deep on their own land, but were less likely to know much about a rock formation ten miles upstream. This is to say nothing about the limitations on how communities understood their work as an element of the larger watershed in which they lived. Instead of thinking in terms of their watershed at large, these communities thought about the individual reaches of the river running past their homes. Where it was not possible to observe the interrelationships between water's flow across space, it was possible to observe its variations in time, and this likely contributed to the intensity with which communities attended to the historical changes in the river's course.

In his account of the floodplain of Hatfield, Massachusetts, Dwight observed that the "Connecticut River anciently ran not only where the houses are now built but nearly half a mile farther Westward and washed the foot of a hill where runs a mill stream called Hatfield mill river. This interval has been greatly extended towards Hadley since the settlement of this country. Several considerable lots have been washed away from the Hadley shore within sixty or seventy

8 Christopher Bickford and Howard Lamar, *Voices of the New Republic: Connecticut Towns, 1800-1832*, Memoirs of the Connecticut Academy of Arts and Sciences, v. 26-27 (New Haven: Connecticut Academy of Arts and Sciences, 2003); Noah Webster, "Bill of Mortality in Hartford With Remarks Geographical and Historical" *Collections of the Massachusetts Historical Society* 3 (1794):4-6; Richard J. Moss, *The Life of Jedidiah Morse: A Station of Peculiar Exposure*, (Knoxville: University of Tennessee Press, 1995); Martin Brückner, *The Geographic Revolution in Early America: Maps, Literacy, and National Identity* (Chapel Hill: University of North Carolina Press, 2006); Jedidiah Morse, *The American Universal Geography, Or, A View of the Present State of All the Empires, Kingdoms, States, and Republicks in the Known World, and of the United States of America in Particular* (Boston: Thomas & Andrews, 1804).

years and tracts equally large have been added to the Hatfield shore."[9] Here, Dwight observed a landscape transformation occurring on a geological timescale. The river originally ran against the hills in western Hatfield and over the centuries it had gradually cut a course farther eastward, depositing silt along the Hatfield bank of the river while eroding it from Hadley. Observations of this change would continue throughout the Early Republic and an 1852 legal case concerning who ought to hold the rights to land made through the process of silt deposition would include testimony that this process of erosion had been ongoing consistently since 1805.[10] Dwight's assessment of the erosive power of the river could be traced back to the status of the floodplain as an ancient lakebed, where it could not be doubted that "this process of alluvion and abluvion which has gone on ever since the deluge or perhaps more correctly ever since Connecticut River broke down the ancient mound between Mount Tom and Mount Holyoke should produce even greater changes than these. The proof that these have taken place is complete."[11] Alluvion and abluvion referred to erosion and deposition. Mount Tom and Mount Holyoke were paired peaks whose water gap formed a narrow neck in the otherwise broad valley of the Connecticut in Massachusetts, making them a likely spot for a dam holding back the waters of an ancient lake. The erosive processes described at Hatfield reflected more than an ongoing process of change in the floodplain's geography. They reflected a process that had begun with the drainage of an ancient lake running northward from Mount Holyoke.

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9 Timothy Dwight, *Travels in New England and New York*, (New Haven: Timothy Dwight Jr., 1821) II:57.

10 *Trustees of Hopkins Academy v. Dickinson* 63 Mass (September 1852) at 545.

11Timothy Dwight, *Travels in New England* II:57.

Interestingly, although Dwight mentioned the Biblical deluge in connection with the ancient lake that formerly filled the valley, he hedged his claims about the connections between scripture and geology by saying "since the deluge, or perhaps more correctly ever since Connecticut River broke down the ancient mound between Mount Tom and Mount Holyoke."[12] Although it could have been connected with the Biblical flood, Dwight's description indicated that its formation and drainage of the lake reflected an ongoing secular process of landscape change. Dwight viewed the Connecticut Valley landscape, and indeed all of New England, as a divinely ordered landscape, but he did not view this landscape according to the dictates of a literal interpretation of the Bible. This reflected a commitment to understanding the geological processes ongoing in the valley independent of their religious import. This approach also provides a clue for understanding the character of geological time as understood by observers of the landscape in the early nineteenth-century United States. Like many of the scholars of geology in Europe at the time, there was an understanding that the Earth was old, perhaps older than the Biblical account of creation, but there were few details indicating what the precise age might be.[13] By leaving out the dates specifying the antiquity of the lake's drainage and an estimate of the time taken in the erosion of the riverbank at Hadley, Dwight left the transformation of the flow of water vaguely defined, and as Ronald Numbers has argued, vagueness in geohistorical thinking facilitated the compatibility between science and religion.[14] The limitations of this outlook, made it possible for Dwight to discuss a landscape whose antiquity dated to time out of

12 Ibid.

13 M. J. S. Rudwick, *Worlds before Adam: The Reconstruction of Geohistory in the Age of Reform* (Chicago: University of Chicago Press, 2008).

14 Ronald L. Numbers, "Science and Religion," *Osiris* 1 (January 1, 1985): 59–80.

mind without needing to nail down precisely when that time was. The assumption that the landscape had been shaped gradually over millennia, and that its changes could be projected into the future for thousands or even tens of thousands of years, meant that he paid attention to the cumulative impacts of gradual changes on the landscape.

Dwight understood a great deal about the geological history of the Connecticut Valley landscape, but the key question is where this knowledge of the land came from. It seems likely that his knowledge of the river's ancient course through Hatfield grew out of his experience growing up in the neighboring town of Northampton and farming the meadows of that town while sorting out his father's estate. Unfortunately, his descriptions of the landscape in the vicinity of Northampton treat the evidence of its status as an ancient lake as a fact already proved rather than one whose evidence remained to be discussed. As a consequence, we need to look beyond his descriptions of the Connecticut Valley to understand what forms of evidence qualified to establish the geological history of a landscape. Dwight developed his account of these processes through comparisons of the variety of rivers on the eastern seaboard. His approach also proved interesting because his methods illustrated the connections between federalist politics and his community-oriented research methods. Taking the time to understand this method, even as it draws us away from the Connecticut into descriptions of river systems ranging from Niagara Falls to the Bosphorus, will help to explain how Dwight understood the Connecticut.

Dwight learned how to interpret the formation of unfamiliar landscapes in conversation with the members of the communities engaged in shaping those landscapes. In part, this resulted from the fact that he was farsighted to the point of functional blindness, meaning that he could take in broad vistas with clarity, but examining it closely took time and effort that he could not muster both because of his disability and because of his status as a traveler. Similarly, extended bouts of reading and writing proved impossible for him, meaning that written accounts of the land would prove beyond his grasp. The *Travels* developed through conversations with his fellow travelers, and conversations with fellow geographers, and the recording of his thoughts by amanuenses. In this sense, the *Travels* can be seen as a collaborative project, collecting the observations of his guides and the community members among whom he stayed while still interpreting these observations an analytical mold grounded in his own experience. In this sense, the genius of Dwight's work lay in his ability to synthesize bodies of shared knowledge about the character of the landscape in New England and New York. Thus, when we ask how Dwight understood the facts of physical geography, then, we need to incorporate the contributions of his companions, informants, and fellow observers into our account.

The *Travels* recount a dozen journeys through New York and New England, indicating Dwight's growing awareness as an observer during the course of the work. During Dwight's first journey through the valley he did not pay particularly close attention to geology, but during the course of his exploration of the landscape—and in communication with Benjamin Silliman, his protege and a budding geologist and chemist in his own right—Dwight came to appreciate how the geological history of the landscape provided a key to understanding how communities managed to thrive within its bounds. Unraveling the thread of geological thought in Dwight's *Travels* reminds us that he did not passively record the character of the landscape or simplemindedly transcribe the ideologies and preoccupations of his era into a travelogue. Instead, Dwight learned about the landscape through the experience of traveling and the act of writing up his experiences. His view of the Connecticut Valley reflected his understanding the geology across New England and New York, which evolved as he explored the landscapes described in the *Travels* between 1796 and 1811.[15]

Dwight looked for patterns in the transformation of the landscape across river valleys. He thought of Niagara Falls as a ready analogue for the drainage process that had turned the Connecticut Valley at Hatfield from a lake into a valley.[16] In his description of the Falls, he speculated that the Niagara River would slowly erode the bedrock away from Lake Ontario and into Lake Erie, eventually reaching the lakeshore and speeding the drainage of that basin. He further compared the workings of the Niagara River to that of the Mohawk River at Cohoes or the Hudson at Glen's Falls, two less dramatic but still notable falls passing over the same limestone bedrock and eroding the riverbed below them at a rate noticeable as he traveled through the region on four occasions between 1798 and 1804. With regards to Niagara Falls, he noted that a gentleman living near the falls for thirty years had witnessed the river retreating a distance of one hundred rods, or about five hundred and fifty yards. But while he acknowledged "that this river, as well as others, must wear away the rocks beneath it, and that the falls must in some degree recede, cannot admit of a doubt. The only question which can arise is, what has been the extent, and what the degree of this operation? These questions it is, in many respects, beyond my power to answer."[17] Dwight's subsequent comments on how seasonality and

15 Fitzmier, *New England's Moral Legislator*; Jane Kamensky, "'In These Contrasted Climes, How Chang'd the Scene': Progress, Declension, and Balance in the Landscapes of Timothy Dwight," *The New England Quarterly* 63, no. 1 (March 1, 1990): 80–108,; Timothy B. Spears, "Common Observations: Timothy Dwight's Travels in New England and New York," *American Studies* 30, no. 1 (April 1, 1989): 35–52; The dates of Dwight's travels are recorded in his introductory letters. Unless his own writing suggests otherwise, this work assumes that his thoughts reflect his perspective while traveling, and not at a later date.

16 Ibid. IV:88.

17 Ibid. IV: 89.

variations in the limestone's porosity acted as a force for variation in erosive processes reinforced this outlook "In some places the stone is soft, ready to moulder, and easily worn away. In seasons marked by sudden and great changes of temperature, the decomposition is rapid and extensive. In other seasons and places, the progress in both of these respects will be comparatively slow. Regularity, therefore, is in no sense attributable to the process."[18] This approach focused on the variations in the rate of change in the erosion of the falls across relatively short time periods rather than the average rate of change across longer time periods, making it possible to wedge the landscape changes occurring at Niagara into the tens of thousands of years that appear to have limited his sense of earth history. The ultimate end of this erosion, however, remained the same. Dwight assumed that the work of the Niagara River in wearing down the falls would eventually cut a channel between Lake Erie and Lake Ontario, improving the drainage of the latter lake and uncovering new reserves of highly fertile farmland. In the act of synthesizing his own observations of the Mohawk and the Hudson with the descriptions of local residents familiar with erosion at Niagara Falls, Dwight engaged in analogizing what he knew about the Connecticut River—that it had slowly eroded a series of massive ancient lakes—to the flow of the Niagara between Lakes Erie and Ontario.

In his journey to Long Island, Dwight was more explicit in describing his field methods, revealing much about the geological problems that attracted his attention and the types of evidence that he collected. In describing the island, he posited two varieties of catastrophic change that could have contributed to its creation, a diluvial rearrangement of land and water or vulcanism. He chose the former on the grounds that the rocks of the island appeared universally

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18 Ibid. (this occurred in Sep. 1804)

rounded and shaped by the currents of the tides rather than a volcanic upheaval. He also observed—and this is the more interesting element of his learning—that excavations for wells and ice houses revealed trees, shells, and even hibernating frogs buried hundreds of feet beneath the surface of the earth. Dwight believed that these provided evidence of a two-part process, beginning with the exchanges of land and sea caused by the deluge, and then the erosive force of the Gulf Stream, which he believed carried sands from the Gulf of Mexico and up the Atlantic Coast. He thought of this force as something like a river within the sea and "by this alluvion, continued through many centuries, were probably heaped up the immense sandy coast, already specified; a vast extent of beach."[19] As a process, his research began with casual observations of the landscape, collecting stones with his travel companions and examining their wear patterns. Secondarily, he talked with landowners and laborers who had participated in the excavation of wells and ice houses, determining the character of the landscape at greater depths disconnected from the landscape itself. Finally, he integrated this understanding within the broader set of geological processes observed in the broader environment. In this case that entailed taking in the nature of the Gulf Stream current, but in other cases it entailed taking in river flows. Although the whole of this evidence provided a rationale for explaining the origins of Long Island, what is really interesting is his reliance on conversations with local residents to gather evidence of the broader geological processes at work in the region.

Dwight's comparative approach to studying river valleys led him to conclude that they generally shared an analogous process of emergence from the beds of ancient lakes. Dwight's search for commonalities among river valleys led him to recognize that "most of those which I

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19 Ibid. III:297. (may 1804)

have called expansions, in the vallies [sic] through which the rivers in this country flow, were once the beds of lakes, formed by barriers extended across their outlets at the lower extremity of each; and that the lakes have disappeared by the breaking down of these barriers."[20] His conviction regarding the origins of valley expansions reflected "an analogy running through all the scenes of nature which I have examined, and producing a conviction, not easily derived from one, two, or a few." The long work of observation had convinced Dwight that the Connecticut actually consisted of eleven discretely identifiable former lakebeds separated by individual water gaps. Beyond the boundaries of New England, Dwight also argued that this process had occurred as the Euxine River cut a passage through the barrier of the Bosphorus and connected the Black Sea with the Mediterranean, and led him to predict that the Niagara River would one day erode a new channel connecting Lake Erie with Lake Ontario.

While it relied on reports from local farmers and landowners, Dwight's comments on the origins of river valleys in ancient lakebeds likely drew on geological work being done in the Hudson Valley of New York and the Seine Valley of France. An English translation of George Cuvier and Alexandre Brongniart's essay on the geology of the Paris basin, which noted that "if this vast plain were surrounded with water, its edges would furnish gulfs, capes, and straights, and would be everywhere surrounded by small islands."[21] While this might seem like evidence of

20Ibid. III:383. (he developed this insight based upon travels occurring in Sep. 1811)

21Georges Cuvier and Alexandre Brongniart, "Essay on the Mineral Geography of the Environs of Paris" *Philosophical Magazine* 35 (1810): 38; Another source making the same claims in the context of the Hudson was Samuel Akerly "On the Geology and Mineralogy of the Island of New York" *American Mineralogical Journal* (4 January 1810): 191-9; The former journal appears in both *Catalogue of Books in the Library of Yale College.* (New-Haven Conn.: Sherman Converse, 1823), http://catalog.hathitrust.org/Record/001165856; and *Catalogue of Books in the Library of Yale-College, New-Haven, January, 1808.* (New-Haven : Oliver Steele, 1808), http://hdl.handle.net/2027/nnc1.50169434. The Latter journal appears in the 1823 catalog.

an elite network of knowledge, it is worth noting that Cuvier sometimes relied on similar sources in his own analysis.[22] It also came a year after Samuel Akerly published an account of the geology of New York and the Hudson Basin that similarly emphasized the significance of the river's geological history as an ancient lake in shaping the landscape. Both of these publications were held by the Yale library. If he did not read them directly—or have them read to him—he could have learned of these developments from his colleague and regular companion Benjamin Silliman, who himself later engaged in active correspondence with Brongniart. Dwight's updated vision of the landscape resulted in the retrospective alteration of his earlier travel accounts, a relatively minor alteration because he had identified these expansions as early as 1796 and already thought of them as significant elements of the landscape deserving explanation; he only developed the means of venturing this explanation in 1811.[23]

Dwight relied primarily on community based descriptions of the landscape and the contributions of his own two eyes when grounding his accounts of the geology and geography. While this made his work an excellent source for understanding how communities described the

22 Adrienne Mayor, "Suppression of Indigenous Fossil Knowledge From Claverack, New York 1705 to Agate Springs, Nebraska 2005" in Robert Proctor and Londa Scheibinger eds. *Agnotology: The Making and Unmaking of Ignorance* (Stanford: Stanford University Press, 2008)

23 Davis Young, "The Emergence of the Diversity of Igneous Rocks as a Geological Problem: Part One—Early Speculations," *Earth Sciences History* 18, no. 1 (January 1, 1999): 51–77, doi:10.17704/eshi.18.1.a82u23018qg65003. Kennard Bork, "Correspondence as a Window on the Development of a Discipline: Brongniart, Cleaveland, Silliman and the Maturation of Mineralogy in the First Decades of the Nineteenth Century," *Earth Sciences History* 18, no. 2 (January 1999): 198–245, doi:10.17704/eshi.18.2.e250tuw214t1l808; ; Mott T. Greene, "History of Geology," *Osiris*, 2nd Series, 1 (January 1, 1985): 97–116; Sally Newcomb, *The World in a Crucible: Laboratory Practice and Geological Theory at the Beginning of Geology*, Special Paper 449 (Boulder, Colo. Geological Society of America, 2009); Kenneth Taylor, "American Geological Investigations and the French, 1750-1850," Earth Sciences History 9, no. 2 (January 1990): 118–25, doi:10.17704/eshi.9.2.60770865651k4301.

flow of water across their own land, it also ran up against the limitations of what communities though was important about landscape change. Timothy Dwight spent much of his *Travels* discussing improved landscapes, but he saw improvement as part of a providential conjuncture between the divine design of the landscape and the act of cultivating that landscape. Thus, improvement had a way of blending into the landscape and proving unrecognizable relative to the agency of rivers.[24] This resulted as much from the presumption that the effective use of a providentially arranged landscape did not necessarily count as an unnatural intervention. In several of its dimensions, Dwight's writing focused on the limits of human agency and the power of nature to shape the character of a settled landscape.[25] The past at work in Dwight's analysis merged geological and historical time. Human labor and the power of the river intermingled freely in the settlement of the Connecticut River Valley. In the generations before Dwight's visits, interventions upon the landscape helped to transform river terraces into town sites, ditched swampy meadows and facilitated their drainage, and generally made the landscape better adapted to human presence. Consequentially, the rhythms of human effort at ordering the landscape could blend into the rhythms of natural processes ordering the landscape, meaning that Dwight's assessment of the landscape assumed that divine ordering had done some of the work that actually resulted from human efforts at shaping the landscape. Springfield, Massachusetts was one place where human work faded into the background. Dwight presented the town as a place "built chiefly on a single street, lying parallel with the river nearly two miles. The houses are chiefly on the western side. On the eastern a brook runs almost the whole length; a fact, which is,

24 Timothy B. Spears, "Common Observations".

25 Larzer Ziff, *Writing in the New Nation: Prose, Print, and Politics in the Early United States* (New Haven, CT: Yale University Press, 1991), p. 130.

I believe, singular. From the street a marsh extends about forty or fifty rods to the brow of an elevated pine plain. The waters of this marsh are a collection of living springs, too cold, and too active, to admit of putrefaction on the surface; and for this reason, probably, the town is not unhealthy."[26] Residents of Springfield faced regular admonitions to clean and reexcavate the channel of the Town Brook, a stream that had originally been cut to drain a swamp at the western edge of the town site. This landscape would later grow into downtown Springfield.[27] Records from the seventeenth century refer to the cutting of a ditch for the Muxie Marsh, which is later referred to as the town meadow, and payments made for the scouring of the trench used to drain the meadow. Dwight did not learn of the human interventions that shaped this landscape. The persistent pattern of sedimentation in the brook, not to mention its location on the levee-ward side of the backswamp abutting the settlement rather than the lower inland side, and the preferential use of the terms trench and ditch in the first generation of its users suggests that the brook had human origins. But nevertheless, by the time Timothy Dwight visited Springfield, the brook looked like a product of water's natural flow rather than the production of working efforts at drainage.[28]

26Timothy Dwight, *Travels in New England* I:283.

27Springfield Town Meeting Records 26 July 1644 reprinted in Henry Burt, ed. *The First Century of Springfield History: The Official Record, 1636-1736* (Springfield, Mass.: Published by the author, 1898) p. 175-6; Springfield Town Accounts 29 December 1674, reprinted in ibid. p. 408-9; "By the selectmen 5 December 1656" in ibid. p. 253; Charles H. Barrows, "Town Brook" *An Historical Address Delivered Before the Citizens of Springfield, Massachusetts May 26, 1911* (Springfield, Mass.: Connecticut Valley Historical Society) Appendix C, p. 80

28The question of how to translate between a ditch and a stream is a problem in both environmental history and restoration ecology; Stuart Lee and Wolff-Michael Roth, "How Ditch and Drain Become a Healthy Creek Re-Presentations, Translations and Agency during the Re/Design of a Watershed," *Social Studies of Science* 31, no. 3 (June 1, 2001): 315–56, doi:10.1177/030631201031003001; Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West*, (Seattle: University of Washington Press, 1999).

Similarly, when Dwight read the landscape of Hatfield, Massachusetts, described in the beginning of this section, he looked upon fields and a village itself whose separation from the river appeared a product of longstanding agreements to maintain drainage networks, but he did not see these institutional means of controlling the flow of water, focusing instead on the arrangement of the landscape at large. A piece of this arrangement is shown in the papers of the town of Hatfield, which describe a 1706 agreement among ten families to maintain drainage networks in their lots on the east side of town.[29] The continued maintenance of such drainage, like the continued maintenance of the Town Brook in Springfield, and indeed the whole array of drainage practices across the valley, played a key role in cementing what Dwight saw as a providentially established harmony between the communities of the valley and its landscape.

Dwight traveled hundreds of miles during the last two decades of his life, gaining an unparalleled breadth of knowledge about the landscapes of the northern United States during the Early American Republic. He relied on the stories told by guides, local laborers, and acquaintances made along the way in his efforts at understanding the landscapes through which he traveled, particularly when he sought to situate his perspectives on these landscapes in the history of the water's flow. It was this process that brought him into contact with ordinary people who learned the features of local working landscapes, and did not have the luxury of time or resources to situate their own lived experience within the context of the regions geology at large. Nevertheless, as we will see in the section on the Agawam River, Dwight observations were consistent with how communities articulated their own memories and expectations regarding

29"Agreement of Samuel Dickinson and Nine Others for the Drainage of Homelots on the East Side of Hatfield" 14 May 1706 in Daniel White Wells and Ruben Field Wells *History of Hatfield, Massachusetts* (Springfield, Mass.: F.C.H. Gibbons, 1910) p. 450-1.

landscape change over the long term rather than an interpreter of novel or hitherto unrecognized landscape features. This is what made him a powerful source for understanding how ordinary people viewed the landscape despite his own lofty status.

Redirecting the Agawam River

The public at large debated the significance of the river's changing course when considering proposals to reengineer alluvial bottomlands. In 1805 and 1815, the people who worked the meadows of the Agawam River in West Springfield, Massachusetts, faced two proposals to redirect that river at its confluence with the Connecticut. Such an engineering project could have created hundreds of acres of farmland, but also might have created new problems of flooding, swamp formation, and erosion. To recreate their perspective, this section considers the difference between draining a field and redirecting a river; the ideas about erosion, property ownership, and drainage presented in proposals to redirect the river; and the contrasting ideas held by meadowland owners who resisted proposals for river engineering. This reveals a conflict where would be river engineers pitted their imagined ability to redirect the river instantaneously while rival community members countered that such proposals ignored the invisible present.

Landowners in the Agawam Meadows took a long-term view of their work in land management, presenting their own drainage work as an act abetting providence while describing engineering proposals as unnecessary and dangerous innovations. They thought about digging a new river channel as an intervention in the landscape that went too far, but they did not oppose the management of drainage in all cases. Local communities might have engaged in a more active politics of water management than Dwight did, but they shared at least one element of his perspective on landscape change. Much like Dwight's assumption that the lay of the land in Springfield reflected the natural flow of water rather than a human intervention in the landscape, the farmers on Agawam Meadow distinguished between their efforts at draining lowlands and proposals to redirect the river and engineer new farmland. This reflected a shared belief that draining wet meadow was an instance where humans revealed the immanent potential of the land. Turning a meadow into a hayfield qualified as an improvement rather than a wholly new work of engineering. In this sense, the debates over redirecting the river through Agawam Meadow reflected a debate over the nature of improvement, and the range of possible improvements to the lay of the land provided the focus for debate. The improvability of a landscape might not be obvious on the surface, and it was possible that proposed projects reengineering the landscape could actually diminish its usefulness and work against the providential lay of the land. Ultimately the bed of the Agawam River remained unengineered, and continued its serpentine course through the meadow, but the debate over water management illuminates how the communities articulated the importance of managing the water flowing through their meadow.

During the Early Republic, the river referred to here as the Agawam was called the Westfield River in the vicinity of Westfield and the Agawam River as it flowed through the Agawam Meadows in West Springfield, just three miles downstream. In essence, the river mattered because of its place in local communities and on local landscapes. It is now referred to as the Westfield River throughout its course. The ability of neighboring towns to claim competing names for a single river reemphasizes the importance of an intensely local, town-based view of river systems that pervaded the Connecticut Valley. In keeping with this perspective, and the language of the primary documents cited, the river will be called the Agawam throughout this chapter.[30]

The Agawam, collected the flow of four streams descending approximately two thousand feet along the eastern slope of the Berkshire Mountains. Its watershed covers of five hundred and seventeen square miles—roughly the size of Phoenix, Arizona—and contains roughly six hundred and thirty-six miles of tributary streams. While the flow of the Agawam into the Connecticut comprises only one-eighth of its total flow, the tributary's relatively short course and rapid descent make it a volatile stream prone to seasonal extremes during the spring thaw and summer low water.[31] The meadows themselves cut through river terraces laid down when the land lay under a glacial lake. This created a rolling landscape where the low flat lands left by former river channels alternated with bluffs and elevated tables of land. This made the Agawam meadows a comparatively narrow, but fertile piece of land subject to rapid variations in the river's height accompanied by pressure from backwater as the Connecticut backed up into the Agawam's channel. In places, the banks of the Agawam cut a gully about ten to fifteen feet deep beneath terraced bluffs, but in spring floods the river rose up to overflow the floodplain.[32] This low-lying stretch of grassy land where the river flows into the Connecticut proved a fertile location for farmland, but also a flood-prone piece of land where the river eroded its banks regularly and cut new courses. The relatively rapid descent of the stream intensified the vast

30Town of Agawam, Massachusetts www.agawam.ma.us accessed 9 June 2015.

31Figures read from hydrographic data at water.weather.gov/ahps2; Detailed descriptions found at Wild and Scenic Westfield River Committee, westfieldriverwildscenic.org; Westfield River Watershed Association westfieldriver.org accessed 9 June 2015.

32Joseph Lathrop, *Sermons by the Late Rev. Joseph Lathrop* (Springfield, Mass.: A.G. Tannatt, 1821) p. L (roman numeral 50).

extents between flood waters induced by the spring thaw and low flows occurring in the summers.

The process of ditching the Agawam meadows began under private and local auspices as early as 1665. During the early years of this process, the only evidence we have of drainage management are the claims of meadowland owners to swampy, boggy, and pondy land adjacent to their existing holdings. This continued through the beginning of the eighteenth century, and drainage processes likely continued outside of government supervision throughout the eighteenth century.[33] In 1796, the state legislature recognized the possibility of conflicts over drainage in wetland areas and passed laws enabling the formation of sewer commissions. These commissions, convened and overseen by the county courts, intervened in cases where no consensus could be reached on the advisability of draining the land.[34] Upon a petition from a majority of the landowners with hydrologically interconnected land, a commission would be empaneled to survey the vicinity and apportion the costs and work responsibilities involved in the drainage process amongst everyone who benefitted from the practice. This proved a controversial mechanism for enforcing participation in the drainage process because of the difficulties that it presented for minorities of landowners who might not have agreed with the process.

Environmental historians agree that the record of drainage produced by sewer commissions and lawsuits contesting drainage practices represents only the tip of the iceberg

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33 Henry Burt *The First Century of Springfield History* vol. 1 (Springfield, Mass.: published by the author, 1898) p. 224-294 reproduces town records indicating such claims.

34 "An Act for Appointing Commissioners of Sewers and Making a Provision for the Better Improvement of Low lands in Special Cases" Mass. Acts 1795 Ch. 62, Approved 26 February 1796.

where the history of landscape modification is concerned. Theodore Steinberg's account of the appropriation of water to power factories along the Charles and Merrimack Rivers described appeals to sewer commissions as a late step in efforts at preserving meadowlands against the backwater ponded by dams.[35] By the time landowners appealed for a commissioner of sewers, they had generally already faced such dramatic transformations in the landscape that their claims could do little to restore the land in the near term. Moreover, they appealed to outside commissioners only reluctantly. Landowners petitioning for a sewer commissioner passed control of their property to a third party, and the binding character of the arbitration process could have unintended consequences in the case of an adverse decision. Alongside the paper records on drainage, Brian Donahue's exploration of the landscape history in towns including Weston and Concord, Massachusetts suggests that focusing exclusively on legal mechanisms governing drainage will result in the writing off of the history of landscape management decisions on the part of farmers working across a catchment—a watershed the size of a farm field or stretch of farm fields sharing common drainage features. Donahue studied ditches running across the abandoned farm fields of Weston and identified instances where farmers had acted in concert to fundamentally reshape the path of water's drainage across gradual slopes occupied by a variety of farms without any apparent legal conflict.[36] This assessment, when considered in light of Dwight's difficulties in recognizing the ditching and drainage efforts of the previous generation in the Connecticut Valley, suggests that ditching occurred anywhere that cultivation occurred, and it might have reshaped the landscape in fundamental ways.

35 Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Cambridge: Cambridge University Press, 1991).

36 Brian Donahue, *Reclaiming the Commons: Community Farms & Forests in a New England Town* (New Haven: Yale University Press, 1999).

Nevertheless, understanding this process remains difficult because the details of running a ditch across a patchwork of interconnected fields often occurred in informal contexts.[37]

The redirection of the Agawam in West Springfield would have been several orders of magnitude more dramatic than coordinating the drainage of several interconnected fields within a catchment. Summer flows ordinarily ranged around five hundred cubic feet per second (cfs), but the highest flows on the river reach about nine thousand cubic feet per second. A stream draining a hundred acre watershed in Hubbard Brook in New Hampshire's White Mountains—equivalent in size if not in topography to a typical meadow—supports average flows of about one-fifth of a cubic foot per second, indicating that the flows of water typically assessed by a sewer commission amounted to between 1/2,500 and 1/45,000 of the mean flow of the Agawam.[38] This type of a change in scale when dealing with drainage provided almost the entire grounds of debate in the petitions to change the river's course.

Petitions to redirect the river emerged because many residents of West Springfield coveted any new land that they could bring under cultivation. Redirecting the river did not represent the first effort at creating new fields. An 1802 Town Meeting in West Springfield approved the resale of lands that had been condemned for the purpose of building roads. An 1803 meeting took up complaints of private land sales by the town's selectmen. An 1805 town meeting considered a petition to grant a sandbar in the Connecticut to an enterprising group of men interested in developing it as a mill site. This proposal came to nothing, and from the context it is difficult to ascertain whether its projectors envisioned a factory or another mill to serve the

37*Coomes v. Burt* 39 Mass. Reports, 422; *Ashley v. Wolcott* 65 Mass Reports, 192.

38"Daily Streamflow By Watershed," Hubbard Brook Long Term Ecosystem Research Study, hubbardbrook.org/data/dataset.php?id=2 Table Two Watershed Three. The exact numbers are 104.71 acres supporting a flow of 0.1732 cubic feet per second.

custom of the town.[39] All of these efforts reflected a desire to create new land in a town already developed and cultivated, and where the bulk of land had already been claimed by the end of the seventeenth century.[40] Indeed, in Joseph Lathrop's sermon on the fiftieth anniversary of his settlement as the minister for the first parish of West Springfield, he noted that outmigration from the parish far outpaced inmigration.[41] The statistical accounts of the town's population bears this out, as the table below indicates. While the population increased by fourteen percent between 1790 and 1800, the rate of increase dipped to nine percent between 1800 and 1810 and fell to four percent between 1800 and 1810.[42] Within this context, the repeated efforts at creating land in the Agawam Meadows suggest that it represented a response to the limited opportunities faced by the town's growing population. The key drivers of these efforts included figures such as the doctor Reuben Champion and Springfield Bridge stockholder Alexander Bliss.[43] Such well-off

39Warrants for Town Meeting 5 April 1802, Item 5, 3 May 1803 Item 3, 12 October 1806, West Springfield Town Meeting Records v. 3, 1794-1815.

40Burt, *The First Century of Springfield*

41Joseph Lathrop, "An Aged Minister Commending His People to God: A Half Century Discourse" in *Sermons Delivered on Various Occasions* (Boston: Isaiah Thomas Junior, 1812) 266. Look in the source on Mass Town population changes you know the one.

42Data is drawn from Jessie Chickering, *A Statistical View of the Population of Massachusetts from 1765 to 1840* (Boston: Little Brown, 1848) p. 25; adjustments based upon Massachusetts Acts 1801 ch. 57 "To set off a certain tract of land in Westfield, in the County of Hampshire and to annex it to West Springfield in the same county" 3 March 1802, which transferred eleven households from Westfield to West Springfield; According to Glendyne Wergland "The Daughters of Rural Massachusetts: Women and Autonomy, 1800-1860" (M.A. Thesis: University of Massachusetts at Amherst, 1995) p. 17, the average family size in 1800 was 6.3, so it is likely that the population in this annexed tract was 69, which was added to the 1800 population to account for the town's changing land area.

43 An Act Incorporating Certain Persons for the Purpose of Building a Bridge Over Connecticut River, Between the Towns of Springfield and West Springfield and for Supporting the Same, *Private and Special Laws of Massachusetts*, 22 February 1803; Reuben Champion Account Books, Umass.

community members would have faced the same pressures on behalf of their families that less wealthy families experienced, but their superior sense of political entitlement made it easier to try creating new marketable land at home.

Year	1790	1800	1810	1820
Population	2336	2835	3246	3270
Population growth	--	14%	9%	4%
Source: Jessie Chickering, *A Statistical View of the Population of Massachusetts from 1765 to 1840* (Boston: Little Brown, 1848)				

In 1805 several West Springfield residents proposed to create new interval lands by straightening a stretch of the Agawam River. They envisioned the new channel as a means of limiting erosion and creating new farmland. According to their petition, the river's course through the Agawam meadows meandered for about two miles while moving forward only about half a mile. With effective ditching the petitioners envisioned opening a channel half a mile long that would release a strip of land measuring about a mile and a half long and one hundred and thirty feet wide.[44] This process would have excavated a connection between the river and Meadow Pond.[45] By shortening the river's course, and moving it from a section of meadowland that was then in high demand over to pond at the edge of the meadowland, the petitioners imagined that they would create new land for sale while reducing the river's erosive properties within the meadows. This reflected an ongoing conflict within the town over the creation of arable land.

44 "Petition to Redirect the Course of the Agawam River" 1805 Senate bill (S.) 3077 Doc. 1 Unpassed Legislation, Massachusetts State Archives (MSA).

45 SC1/series 50: Third Series Maps, vol. 21 p. 9 no. 1629 (MSA)

In documents presented before the legislature, petitioners arguing for and against engineering the channel presented contrasting accounts of how seasonal high water contributed to erosion. The petitioners attributed erosion to the flow of water following heavy rains, while the remonstrants countered that erosion occurred during spring freshets, where high water in the Connecticut backed up the waters of the Agawam. Heavy rains caused flood events that could occur almost any time throughout the year. In these rains, the water rose much more quickly in the Agawam than it did in the Connecticut, so digging a channel that sped the flow of water through the valley would reduce flooding. Opponents of the ditch countered that the erosive power of the river reached its peak during the spring floods, a period where the flow of water in the Connecticut could reverse the flow of the lower Agawam and backwater from the main stream flooded the tributary and its meadows.[46] The remonstrants further maintained that the particular problems with erosion within the meadows occurred as strong winds drove the stream's water into its banks during these periods of high water saying: "even if it should be profitable to confine the river, at low water, to the proposed course, still upon every freshet [flood] or rise of water, which are very frequent in that river, the water would with certainty flow in its present course: and as the river wears upon its banks only in high water, the same waste will be experienced after the turning of the river as is experienced now."[47] When they focused on the erosive power of water during the freshet, the remonstrants emphasized the problems that could arise from straightening the river's course. During backwater, the ice accumulating at the river's mouth during the spring thaw raised the likelihood of an ice jam, which would raise

46 S 3077 Doc. 6 MSA

47 "Answer by the People of West Springfield" 1805 S 3077 Doc. 4 MSA.

floodwaters whose uneven wear patterns—exacerbated by flood debris—would drive erosion and draw the river back into a serpentine course.

The dispute also concerned how rivers contributed to change on a geological timescale and contrasting ideas about what types of land would emerge in the years following the redirection of the river. This too reflected their contrasting understandings of how water flowed through the meadow. The petitioners envisioned a riverbed banked off from the upstream source of its floodwaters and opened up for cultivation, while the remonstrants maintained that every spring freshet would draw the river's water back into its old channel, contributing to renewed and exacerbated erosion and perpetuating an ongoing problem that had been the work of drainage since settlement in the seventeenth century. They concluded: "if the river should at some different time wholly leave its present bed, it will, like the other ancient beds of the same river, be a continual chain of ponds and sunken marshes, useless from time immemorial."[48] The question of timescale in river engineering reared its head here. While the petitioners had addressed their visions in terms of instantaneous change through engineering, the landowners already in the meadow worried that this vision would actually entail watching an ongoing geomorphic process where formerly accessible farmland washed downstream after the excavation of a new channel and lands earmarked for new farmland remained boggy marshes during the interim.

The petitioners and remonstrants arguing over the 1805 proposal staked out their positions for representatives who would have been familiar with how rivers shaped erosion and deposition in an alluvial valley. One of the representatives appointed to investigate these

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48S 3077 Doc. 5.

petitions, Epaphras Hoyt, likely knew more about physical geography than any of his colleagues in the legislature, and he would have joined his family—featured prominently in the previous chapter—in working alluvial fields that regularly flooded when high water on the Connecticut backed up the Deerfield. He was something of a local expert in physical geography, having coauthored a textbook on the subject and trained Edward Hitchcock—who would go on to carry out the first geological survey of Massachusetts. Indeed, Timothy Dwight described the rebuilding of the road from Deerfield to Greenfield at the margin of the interval lands along the Deerfield River. He observed that the road had formerly been "exposed to serious inconveniences. As it crossed the interval between these towns, it was deluged by the river whenever its waters were high, and was, also, rendered troublesome by a ferry."[49] Incidentally, this bridge had been opened by the Hoyt family and managed by John Hoyt. Thus, Epaphras Hoyt would have been familiar with questions about what caused the majority of flooding, including, how exactly these high water events transformed the landscape and whether the water wore directly upon the banks or if it erosion resulted from high winds and high water. Ultimately, even if he had little familiarity with the Agawam meadows as a place, his experiences with the Connecticut and its tributaries qualified him to judge whether it would be possible to engineer the drainage of a river channel.

The debates over the Agawam meadows of 1805 did not result in the re-engineering of the river, but neither did they result in the abandonment of dreams of river engineering. A decade later, another series of petitions reframed the argument in favor of excavating a new channel in terms of assuring the integrity of the riverine landscape throughout the Springfield reach of the

49Dwight, Travels II:62-3

Connecticut rather than simply in reference to the town of West Springfield. These petitions, initially mooted in 1813, but formally taken up for debate in 1815, started from an understanding that the river's course was changing, but once again the petitioners and the remonstrants failed to come to any agreement about how exactly these changes were developing. They debated the relative likelihood of instantaneous and gradual changes in the river's course, and ultimately, in deciding not to engineer the river, committed to a prediction of gradual adjustment.

The 1815 petition brought in an element of historical argument, where the petitioners observed that the river was in the process of changing its own course and argued that such a change could disrupt the landscape of both Springfield and West Springfield. They went on to claim that the natural process creating a new channel through the Agawam Meadows would cause property disputes among the meadowland owners, and the formalization of the channel management process through engineering would help settle those disputes. The petitioners also predicted that the river would cut a new mouth approximately one mile downstream at the foot of the Springfield Bridge, potentially destabilizing the piers of that structure. Thirdly, they argued that allowing the Agawam to flow into the Connecticut at this lower point would increase its flow past Springfield Village, present-day downtown Springfield, in a fashion that would erode the banks of the river as it flowed through that more heavily developed town. This argument, which its opponents dismissed as being of dubious hydrological merit, made the problem of the Agawam Meadows a problem that crossed the jurisdictional boundaries of West Springfield and thus engaged the state at large.[50]

50"Petition of Alexander Bliss and Others to Change the Course of Agawam River" 10 June 1813, Doc. 1, 1815 S 5209 MSA

The 1815 remonstrance against changing the course of the river envisioned a problem of gradual change rather than the specter of a sudden and dramatic jump in the river's course. It sought to regularize the changing flow of the river rather than emphasizing its potential for sudden transformation. Thus, it asked the general court "whether any of your honors are acquainted with rapid streams passing through a loose and sandy soil where possibly it has been all made land, and have not known that the bed of such streams is liable to and does frequently gradually change?"[51] These gradual changes would continue to occur even in the face of correction to the river's flow. The remonstrants framed their objections, in part, by describing their expertise in reading the history of the river's flow, and in part by arguing that the petitioners failed to comprehend the natural processes at work in the river's flow. The remonstrants answered claims about the conflicts arising from the transformation of the river's course by arguing that the common law provides adequate recourse for dealing with the transformation of river courses. In making this argument, the remonstrants revealed that they operated under fundamentally different assumptions from the petitioners regarding the nature of the landscape change ongoing in the Agawam Meadows. The petitioners believed that the river's changing course was a problem to be solved, while landowners in the meadows believed that it was a standard element of its flow.

In this remonstrance, the severity of flooding from mountainous sources served as the argument against transforming the river's flow. The remonstrants maintained that it would be "morally impossible so to turn the course of the river that it will not occupy its old bed more more or less at all times and especially for weeks and months after every freshet."[52] While their

51"Remonstrance Against the Bliss Petition" 1815 S 5209 Doc. 7.

52 Ibid.

claim about seasonal threat of flooding and the power of these seasonal floods to redirect the river into its former bed described straightforward physical processes, the question remains why this would prove morally impossible. Any attempt at reshaping the river's course would necessitate an ongoing project of maintenance and embankment rather than an instantaneous act of engineering, particularly as the floodwaters of the Agawam could raise the water more than ten feet above its ordinary level. Taking recourse to reengineering the river before this threatened change in its course would oblige them to take similar measures any time the river threatened to change its course. If appointed commissioners—rather than elected officials or traditions grounded in the property rights of existing landowners—decided what course the river ought to take and reassigned riparian property, this would invite corruption. The remonstrants argued that this meant "the commissioners must be immortal, or as in a despotic government where children are born to inherit offices, their children must be born commissioners."[53] This might have exaggerated the threat posed by redirecting the river, but at the same time, pointed to the failure of the petitioners to represent their proposal as one grounded in the decade- to century-long timescale associated with alluvial erosion and deposition. The river's redirection would create the necessity of ongoing maintenance, management, and it still would not eliminate all of the need for adjudicating land use.

The question of timescale persisted in the discussions about the changing landscape, and in the 1815 debates the soil's depth and looseness, also described as its sedimentary character or its character as made land, was indicated by the regularity with which the riverbank's erosion revealed trees and logs whose roots began as many as fifteen feet below the soil surface. While

53 Ibid.

the landowners argued that while the gradual accretion of soil on the surface of the meadow occasionally gave way to wholesale changes in the river's flow as it jumped its bank, the consequences of such changes only became visible over the long run. They maintained that the excavation of another channel for the stream would create an oxbow lake that would last for centuries. In this account, the human art of recreating the river could never act as decisively as the river's own flow in shaping its bed. Finally, they concluded that the river would only jump its course and flow into the Connecticut at the foot of the bridge after gradually shifting its mouth southward by between eight hundred and a thousand feet. This remained unlikely in the near term in their assessment of the gradual transformation of the river's course.[54]

Debates over the course of the Agawam revealed the mechanisms by which landowners in the Agawam Meadows dealt with changes in the river's course. Rather than turning to the courts to adjudicate these differences, the remonstrants relied on a system of land titles that included the acreage held by each owner in addition to its location, meaning that land suddenly taken from one property into another through the transformation of the river could be reclaimed amicably without recourse to the courts.[55] The defense of the existing flow regime and distribution of property within the Agawam Meadows reflected a broader sense of the weight of time's passage upon the landscape. While residents of West Springfield undoubtedly understood that the seventeenth century had been a period of land distribution and the creation of new cultivable lots through drainage practices, they also argued that such drainage practices should be left as a historical marker of settlement and not revived as a means of distributing new land. This perspective rested on a belief in the significance of the river's deep history of geomorphic

54"Inhabitants of the First Parish of West Springfield Against the Petition" 1815 S 5209 Doc. 8.

55 Ibid.

changes stretching back into previous centuries and indicating that the existing order depended on a willingness to subsume the history of the working landscape into an understanding of geological change.

Edward Hitchcock's geology: A Coda

Edward Hitchcock learned natural history from Epaphras Hoyt, and Benjamin Silliman. The former appeared in the previous section as one of the state representatives investigating the proposal to reengineer the river and the latter was Timothy Dwight's protege and the first professor of science at Yale. Hitchcock's first publication in geology, shepherded into print by Silliman, virtually repeated the vision of landscape history provided in remonstrances against the redirection of the Agawam River. Thus, even if Hoyt's practical investigations of the landscape did not directly shape Hitchcock's scholarly writing on the Connecticut River Valley, Hoyt's role in Hitchcock's education surely encouraged parallel insights. The remonstrance argued that "trees and logs are frequently washed out on the bank of the river at a depth of between ten and fifteen feet below the surface of the soil," while Hitchcock argued that "it is not unfrequent to find ten or fifteen feet below the surface of the most recent of this alluvion, logs, stumps of trees, leaves, butternuts, walnuts &c in a partially decaying state."[56] The two statements are similar, but not quite identical, but it would be reasonable to suspect that Hoyt, as a mentor and colleague of Hitchcock's would have shared some of the public statements found in those petitions.

Hitchcock's career arc would lead him away from democratic science and a concern for alluvion into a more specialized and professional perspective on geology. Edward Hitchcock

56 Ibid.; Edward Hitchcock, "Remarks on the Geology and Mineralogy of a Section of Massachusetts on Connecticut River, with a Part of New-Hampshire and Vermont," *American Journal of Science* 1, no. 2 (1819): 106–15

began his career in natural history with two practices illustrative of his connections with Dwight and Hoyt. He spent the early 1810s working with Epaphras Hoyt in fields including astronomy and ultimately published an almanac based upon his observations. Later, in 1816, he began sharing mineral specimens that he collected in the Deerfield hills with Benjamin Silliman.[57] He engaged in this correspondence while living at home and working on his brother's farm during the early 1810s and continued it during his employment as the principal of Deerfield Academy between 1815 and 1818. With the temporary closure of the academy in 1818, Hitchcock traveled to Yale to train in the ministry. While there, Silliman helped him publish his first geological paper in 1819 in the opening volume of the *American Journal of Science*—to which the journal *Science* is a successor. After entering the ministry, Hitchcock spent five unhappy years in the pastorate at Conway, Massachusetts where he complained that many of his parishioners demanded "a much greater share of parochial and social visits than is possibly consistent with other duties."[58] After leaving this pulpit—ostensibly for his health, but also because of his intellectual ambitions—Hitchcock became Amherst College's first professor of natural history in 1825.[59] While teaching at the college, he followed three lines of inquiry. First, he carried out the first state sponsored geological survey during the 1830s. Second, he lectured and wrote

57 Elizabeth Harriet Thomson and Leonard G. Wilson, eds., *Benjamin Silliman and His Circle: Studies on the Influence of Benjamin Silliman on Science in America* (New York: Science History Publications, 1979); Chandos Michael Brown, *Benjamin Silliman: A Life in the Young Republic* (Princeton, N.J: Princeton University Press, 1989).

58 Hitchcock quoted in J. M. Opal, *Beyond the Farm: National Ambitions in Rural New England* (Philadelphia: University of Pennsylvania Press, 2008) 165.

59 Hitchcock's intellectual biography is nowhere set down in its entirety, but it can be pieced together from Ibid.; Edward Hitchcock, *Reminisces of Amherst College: Historical, Scientific, Biographical, and Autobiographical* (Northampton, Mass.: Bridgman and Childs, 1863); Idem., *Final Report on the Geology of Massachusetts* (Northampton: J.H. Butler, 1841).

extensively on the relationship between scripture and geology. Third, he played a major role in introducing the glacial theory as an explanatory mechanism for the phenomenon of drift, or diluvium, to the United States. During an intellectual life that spanned half a century between his publication of *A Country Almanac* at Deerfield in 1813 and the completion of his memoirs in 1863, he lifted himself up from an amateur natural historian with interests in astronomy and mineralogy to the presidency of the Association of American Geologists.[60] In the course of his rise, he displayed significant insight into the changing modes of explanation that his European colleagues adopted, generally keeping himself on the leading edge of geological practice throughout his forty year career at Amherst College.[61]

Although in many ways an heir to Dwight and Hoyt, Hitchcock paid less attention than his forebears to alluvium and the changing flow of rivers. Instead Hitchcock focused on building a new orthodoxy grounded in natural theology and a sense of the disciplinary autonomy of geology.[62] Geologists stopped presenting their fieldwork as a result of intensive partnerships with local communities and increasingly relied upon expertise and specialized knowledge in reading the landscape.[63] Consequently, the conversational public engagement that had animated Dwight and Hoyt's democratic science took a back seat to public lectures and demonstrations intended to

60 Edward Hitchcock, *The Country Almanack, Adapted to the Convenience of Farmers, for the Year of Our Lord 1814: And Year of the World according to Scripture, 5776 : Being the Second after Leap Year, and 38th of American Independence : Fitted to the Town of Deerfield, in North Latitude 42° 32-1/2' and in Longitude 72° 41' West from Greenwich* (Greenfield Mass.: Denio & Phelps, 1813); Idem., "First Anniversary Address Before the Association of American Geologists," *American Journal of Science and Arts* 41 (1841): 232–75.

61 Evidence of this attention appears in the succeeding editions of Hitchcock's *Elementary Geology*, (Amherst: J.S.&C. Adams, 1840; 1841; New York: Dayton and Newman, 1842; New York: M. H. Newman, 1847; New York: Ivison and Phinney, 1855; 1859; 1860; 1862; New York: Ivison, Blakeman, and Taylor, 1871)

62 Ronald L. Numbers, "Science and Religion."

diffuse scientific knowledge within popular culture at large. This transition eliminated some of the easy interactions with the public that had animated Dwight's travels. Engagement with and listening to people who were working the land gave way to a practice grounded in talking to those people. Hitchcock participated in debates over natural theology, fossil taxonomy, and what is now known as the geology of glaciation, but in Hitchcock's time was called diluvium. The general thread of his argument was the lack of a direct relationship between the depiction of nature—particularly the mosaic deluge—in the Bible and the floods, and later glaciers, that he believed had shaped the New England landscape. Hitchcock guided his audience away from a belief that evidence of the Deluge could be collected from the face of the earth in the Connecticut Valley and he helped to transform the meaning of diluvium. Where Dwight had seen the landscape as the embodiment of God's promise to devout New Englanders, Hitchcock's focus on the erratic cobbles, boulders, and outwash described under the rubric of drift or diluvium drew his attention to the difficulties presented by the New England soil. Reading the landscape through natural theology rather than divine providence made it possible to find God's presence in the array of erratic boulders that littered the uplands. This provided Hitchcock with a means of effectively educating a student body who would likely scatter across the globe after the completion of their educations.[64]

Perhaps most dramatically, Hitchcock began treating the teaching of geology as a practice that occurred outside of engagement with communities in the Connecticut Valley. He made a practice of leading his senior classes on field trips where they would claim and rename a

63 J. M. Opal, *Beyond the Farm: National Ambitions in Rural New England*, Early American Studies (Philadelphia: University of Pennsylvania Press, 2008).

64 Hitchcock, *Reminiscences* 237-9.

geological feature of the landscape, "by right of conquest" and sometimes over the objections of the local community. In 1849, the senior class presumed to rename Mount Toby, in Sunderland, Massachusetts Mount Mettawompe, much to the consternation of the town meeting in Sunderland. This prompted a municipal resolution criticizing their suggestion, saying "as the citizens of the town of Sunderland, we consider the associations connected with the history of the past too sacred and the reasons assigned for the change to trivial, to justify us in assenting to the change."[65] Rather than making connections with local communities, Hitchcock emphasized the significance of these renaming efforts for helping his students to act independently in identifying and naming the landscapes upon which they trod. In this, they acted out the process of conquest then going on in the western territories of the United States. In his words, "our geological excursions have often had the double object of studying the rocks and by appropriate speeches and ceremonies of naming some of these objects. This would seem to be a very easy and pleasant undertaking; but I have often found it so laborious, and encountered such malignant opposition, that I have again and again resolved at the close of our excursion that I would never attempt another."[66] These adventures did, however, provide students at Amherst with a sense of the entitlement and self-regard necessary to move geology away from the communities where people worked with the stones and the soil and make it a language for interpreting new places on earth.

The ubiquitous stones that gave New England a reputation for poor soil provided an object for study in Hitchcock's work. They provided a means of focusing in on the key factors that would drive his students out of New England in search of their fortunes. As the visions of creating new floodplain lands in the previous section indicated, the prime farmland that had

65 Ibid. 237.

66 Ibid. 212.

made the Connecticut Valley a rich and inviting place to settle during the seventeenth and eighteenth centuries had become quite dear during the opening decades of the nineteenth century and driven the nucleating settlements of New England into the hills, and even over the border into New York's Hudson and Mohawk Valleys. The trend posed an educational challenge for Hitchcock because he no longer needed to prepare his students to merely occupy the farms on which they had grown, but instead they needed to find new lands and new opportunities for cultivation. This helped to prompt the shift to a professionalized geology because there was no longer a lay population intimately familiar with the landscape in the areas under geological investigation. At the same time, it prompted increasing attention to natural theology rather than the providential description of individual landscapes because his students needed to be able to adapt their sense of god's favor to any landscape that they inhabited rather than a landscape with which they were familiar.

Conclusion:

Edward Hitchcock's career illustrated why the geological profession moved on from questions about alluvion and abluvion. While the communities established and thriving in the Northeastern United States provided the focus for Dwight, and grounds for debates over river engineering throughout the early nineteenth century, they did not represent the whole of the American experience. Hitchcock thought about his work as a process of educating students for the landscapes where they might live, not just the landscapes where they had grown up. To this end, he turned his gaze beyond the limits of established townships and paid particularly little attention to the well-established floodplain communities on the floor of the Connecticut Valley.

This reflected the expanding horizons of the field of geology and of American society more broadly.

It did not, however, diminish the significance of learning the local landscape for people who lived and worked with the river on a day-to-day basis. River dynamics remained at the center of their ideas about the past and the flow of water throughout the period 1790-1870. Popular approaches to geology persisted through the end of the Civil War. Communities continued to ground their positions on the transformation of the landscape in accounts of the region's geomorphology. At the same time, the professionalized wing of geology changed its orientation to meet the demands of a country undergoing rapid expansion. The new U.S. territories in the West encouraged surveys across broad swathes of land that they thought of as hitherto unexplored and unpeopled. Consequently, the skillset associated with learning geology through conversations with locals familiar with the landscape through its intensive use became devalued relative to the discovery and description of the economic potential of new places.[67]

The disconnection between the geology experienced in everyday life and the geology presented by experts could become quite dramatic. One of the mill owners at Holyoke, Massachusetts—a planned city that became one of the most thoroughly industrialized places in the valley between the 1850s and the 1870s—opined in 1882 that "so long as New England was covered in eight feet of gravel she would either manufacture or starve."[68] When we contrast this view with Dwight's description of the material abundance covering every cultivable strip of land

67 This bifurcation is described in the British Context by James R. Moore, "Geologists and Interpreters of Genesis in the Nineteenth Century" in Ronald Numbers and David Lindberg eds. *God and Nature: Historical Essays on the Encounter Between Christianity and Science* (Berkeley: University of California Press, 1986) 322-350; The growth of an imperial science in the American context is described in Lewis, *A Democracy of Facts.*

68Cumbler, *Reasonable Use* p. 5

north of Mount Holyoke a grand contradiction underlying the landscape of the nineteenth-century Connecticut River Valley reveals itself. The farms that stretched across the expansions in Dwight's view of the nineteenth-century Connecticut Valley did not disappear with industrialization, but their place in New England society changed as it became clear that they could no longer provide for each generation's increase in the population. They could provide abundance, but not growth, and consequently it became increasingly important to provide the children raised in this landscape with opportunities to grow out of the valley.

People growing into lives and careers that would stretch beyond the valley depended on knowledge that differed fundamentally from the families who stayed behind.[69] The pace of wear caused by a river's changing course remained at the center of community understandings of geology even as it receded to the margins of its academic study, more important as a future fossil than as a current event. Hitchcock's increasing attention paid to how people lived outside the valley, and perhaps more strikingly, the portion of the community for whom the valley could not provide, meant that instruction in natural history and particularly geology, required a more mobile and changeable sense of providence. No longer could specific landscapes be seen as gifts to specific communities, as the fissioning of those communities and the independent migration of community members required a more open-minded sense that opportunity could be anywhere, if only people could find a way to improve it. The changing economic scenario in the Connecticut Valley encouraged outmigration, and in places like Edward Hitchcock's Amherst, this outmigration raised questions about the geology outside of the most populous communities in the valley.

69 Hal S. Barron, *Those Who Stayed behind: Rural Society in Nineteenth-Century New England* (Cambridge: Cambridge University Press, 1984).

For those remaining in the valley, however, an understanding of the river's flow grounded in weather, geology, and—as we will see below—history remained a key element of how they worked with the landscape in their everyday lives. Residents of the Connecticut Valley floodplain shared an awareness that the ground under their feet was shifting. Slow processes of erosion reshaped the river's banks, and across the period of centuries it might confidently be predicted that the apparently solid alluvion that they cultivated would one day be drawn downstream and replaced with newly deposited soil, perhaps on the bank opposite their farm. While residents of the valley understood this general principle, they debated its implications. During the early decades of the nineteenth century, enterprising figures continued formulating proposals to redirect the river's course, most notably at the Hockanum bend, about two miles upstream from the South Hadley Canal, a navigational improvement designed to bypass the eponymous falls located just a mile south of Mounts Holyoke and Tom. This oxbow turn, one of the half dozen celebrated by Timothy Dwight when he described the landscape upstream from Mount Holyoke, proved a central target for landscape modification. But the navigational improvements active on the river between the 1790s and the 1830s presented their own challenges in the public understanding of water's flow, and only some of these challenges stemmed from proposed changes in the river's course.

Chapter Three:
The Business of Canalling:
Changing Strategies for Navigating the South Hadley Canal, 1790-1828

When the Proprietors of Locks and Canals on the Connecticut River held their first meeting in 1790, they had two items on the agenda, acquiring a charter from the state legislature and finding somebody "familiar with the business of canalling" who could help them plan a waterway that navigated around the South Hadley Falls.[1] The proprietors believed that a canal would speed the flow of trade downstream and encourage economic development, but they had no frame of reference for understanding how such a structure would reshape the river and its floodplain. Neither did upstream landowners. Rather than an isolated work of engineering that opened a channel skirting the South Hadley Falls, the canal would transform the flow of water through meadows that lay as many as five miles upstream and a mile inland from the riverbanks. The farmers living and working in this broader hydrological complex also had no frame of reference for how the canal might transform their land, and they too learned about the business of canalling while living with the canal.

The canal at South Hadley Falls did not create a wholly new waterway on the order of the Erie, Midi, or Panama Canals.[2] Instead, it cut a new channel for an existing waterway that used

1 "Notification of President and Directors" 24 December 1790, Proprietors of Locks and Canals on Connecticut River Records (L&C), 0455N Box 10, Doc M-2,r.

2 Ashley Carse, *Beyond the Big Ditch: Politics, Ecology, and Infrastructure at the Panama Canal* (Cambridge: MIT Press, 2014); Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal Du Midi* (Princeton: Princeton University Press, 2009); Carol Sheriff, *The Artificial River: The Erie Canal and the Paradox of Progress, 1817-1862* (New York: Hill and Wang, 1996).

locks and an inclined plane to guide boats around the falls. To carry out these navigational changes, the proprietors needed to hold back water in the floodplain, and it was this effort that set off the legal conflicts underlying the canal. The proprietors—and their upstream neighbors—did not know how canal construction would transform the fluvial landscape on a regional scale. The engineers and surveyors responsible for designing the structure presented the proprietors with a stark choice. They could engineer a canal behind a tall dam that would extend the process of drainage during the spring floods or they could engineer a canal behind a short dam and a series of locks that would cut through the bedrock geology surrounding the falls. They could modify the seasonal flow of water across the landscape while leaving its geology unchanged or they could modify the geological landscape and leave it unchanged on a seasonal timescale. Their choices in solving this problem would define the political debates over how the canal, and its connected dams, locks, and other infrastructure ought to manage water.

Instead of forging a wholly new set of flows—a new watershed—the South Hadley Canal drew together the hydrological interconnections between two apparently independent reaches of the river. These interconnections proved consequential in two ways. First, the disruption of drainage, fisheries and public health prompted a broad political conflict that revealed the interconnections between canal building and landscape change. Second, the politics of dam building at the turn of the nineteenth century lived on in the historical memories of upstream towns, who persisted in protesting new dams every time the proprietors rebuilt their canal's works. In mobilizing historical memory, and local understandings of seasonality, upstream communities managed to articulate protests against the dam at South Hadley that ultimately shaped its construction and operations. Indeed, the memory of these conflicts lived on beyond the life of the South Hadley Canal and shaped the charter and operations of its successor in dam building, the Hadley Falls Company, an issue which will be explored in chapter five. Thus, fitting the history of the South Hadley Canal into the broader context of a changing river will help to explain how temporalities grounded in natural history came to shape the historical memory of water politics in the valley.

Figure 3: Upper Map: Detail from John G. Hales Plan of Northampton Massachusetts showing the Oxbow meadows and the fisheries of the town upstream at the river's bend modified from http://www.historic-northampton.org/members_only/maps/1831.html; Lower Map: detail from United States Geological Survey Springfield, MA Quadrangle, 1895, modified from http://docs.unh.edu/nhtopos/SpringfieldMA.htm

The hydrological interconnections between South Hadley and Northampton

Before any dams traversed the landscape, the South Hadley Falls marked a reach where the Connecticut River descended nearly sixty feet through two strings of rapids separated by a thirty-foot ledge of rock. During this descent, the Connecticut River banks rose in a series of bluffs on the downstream side of the water gap separating Mount Tom from Mount Holyoke. The dense red sandstone of these bluffs made canal excavation difficult because they hemmed in the banks of the river. North of Stony Brook—which served as the head of the canal—arose Mounts Tom and Holyoke. Winding upstream between these peaks into Northampton and Hadley, the riverbed rose only gradually. In the present day, the river gauge directly upstream from South Hadley Falls measures the water level from a base height only 1.53 feet lower than the gauge at Northampton. This minimal drop over a distance of approximately five miles suggests how any small alteration to the flow of water at South Hadley Falls would prove noticeable in Northampton proper.

Proceeding farther up the Connecticut all the way to the foot of Turners Falls canal—a distance of about forty miles—the river rises only three feet.[3] Across this broad flat floodplain, the river's flow determines the flow of its tributaries. To this day, the gauge measuring the flow of water on the Connecticut River at Northampton actually sits on the Mill River at the base of the town's flood control levee rather than along the Connecticut proper, indicating that the Mill and the Connecticut share a virtually equivalent bed elevation throughout the meadows. The gradual rise of the river in this reach corresponded with the wide stretches of fertile floodplain fields. Timothy Dwight evoked the wealth of this land as a function of its interval fields,

3 Data from Northeast River Forecast Center, weather.gov/nerfc. Holyoke is 97.47 feet above sea level, Northampton measures from 99.0 feet, and Turners Falls measures from 99.87 feet.

"containing from five to five hundred acres, interspersed with beautiful and lofty forest trees, rising everywhere at little distances, and at times with orchards, of considerable extent, and covered with exquisite verdure. Here spread, also, vast expansions of arable ground, in which the different lots exactly resemble garden-beds, distinguishable from each other only by the different kinds of vegetation, and exhibiting all its varied hues, from the dark green of the maize to the brilliant gold of the barley."[4] If the dam at South Hadley raised the floodwaters of the Connecticut to any considerable extent, it would disrupt drainage patterns in these fields. Moreover, the problems with drainage would not be divided evenly across the floodplain. A natural levee along the Connecticut raised the level of the riverbanks above the surface of the stream, but this levee declined as the intervals moved inland, meaning that the amount of water pooled in backswamps—poorly drained stretches of land located where the meadow edges met with the brow of a hill leading into the uplands—could exceed the amount pooled adjacent to the river itself. This proved to be a particular problem in the meadows upstream from the canal drained by Easthampton's Manhan River, Northampton's Mill River, and Hadley's Fort River. These meadows began in floodplain terraces lining the banks of the Connecticut and generally sloped downward as they moved away from the riverbank. Former riverbeds cutting through these terraces provided additional arms of low-lying land that vacillated between wet meadow and swamp.[5]

4 Timothy Dwight, *Travels In New England and New York* (New Haven: Timothy Dwight Jr., 1821) I:318-319.

5 David Fleming, "The Lost Meadows of Northampton" *Massachusetts Review* 54 no. 1 (June 2013):115-144 provides an overview of the landscape as it appears in the present; Frederick Kneeland, *Northampton: The Meadow City* (Northampton: Kneeland and Bryant, 1894) Google Books, described the romantic view taken of these lands during the late nineteenth century.

The broad, flat character of this stretch of river contributed to dramatic seasonal variations in drainage. The spring floods accounted for the majority of the runoff in the Connecticut Basin and pooling these floodwaters behind a dam—as iterations of the South Hadley Canal did—slowed that runoff. This slowed the drying of spring mud and the commencement of plowing. The rapidity of seasonal drainage played a significant role in the preparation of the fields for plowing after the spring thaw. The meadows in this region consisted of common fields, owned by a group of proprietors who shared responsibilities for maintaining fences and collectively grazed livestock on the fodder left behind after each year's harvest.[6] Their existing organization for the management of boundaries in shared land meant that they paid avid attention to the effects that dam building had on their properties, and organized to act collectively when the time came for demanding legislative redress for the damages that they suffered.

Similarly, the people who fished in the pools abutting meadows upstream from South Hadley Falls paid careful attention to events that interrupted their rights. The Manhan, Mill, and Fort Rivers housed common fisheries, which proved most active in early May. Much like the common fields that abutted the fisheries, the right to fish in these commons was subject to tight restrictions governed by riparian landowners.[7] They became an object of public interest not because of the general right to fish, but because of the community-oriented trade in fish that occurred at fishing places during the spring shad runs. The majority of fishing on these runs occurred where meadows abutted pools of slow moving water at breaks in the current—a pattern

6 J. Ritchie Garrison, *Landscape and Material Life in Franklin County, Massachusetts, 1770-1860* (Knoxville: University of Tennessee Press, 1991) describes the management of analogous meadows upstream in Deerfield.

7 Strother E. Roberts, "The Commodities of the Country: An Environmental Biography of the Colonial Connecticut Valley" (Ph. D. Dissertation, Northwestern University, 2011) 262-297 discusses the transformation of the fisheries in the valley during the colonial period.

of flow commonly found in the eddies formed by the confluence of a river with its tributary stream.[8] Historically, these privately managed fisheries had provided a public benefit because they formed a gathering place where residents of upland communities would travel during the early spring to purchase barrels of shad and participate in the celebratory culture that surrounded the netting and pickling of fish.[9] This trade featured a public element in the shad festivals and the community investment in consuming fish, but at the same time, it also featured a private element, as the right to fish the river adhered to the ownership of the riverbanks themselves. Untangling the private and public elements of fisheries operations would prove a crucial element of the legal wrangling over dam building.

Regulating and Managing the Business of Canalling: Institution Building and Memory as Factors in Water Management

The politics of water use in this region reflected a general unfamiliarity with how a canal might reshape the landscape, but they also reflected the uncertainties surrounding political jurisdictions that would govern new forms water use. The proprietors operated in a society where the jurisdictions and procedures for protesting environmental problems remained unclear.[10] The petitions and remonstrances used to intervene in this period reflected uncertainty about whether water management was the responsibility of the state and county courts or the state legislature.

8 Gad Warriner, Petition to Reinstate the Agawam Fishery, 1819 Sen. 6407 Doc. 2, Massachusetts State Archives, Boston.

9 John Cumbler, *Reasonable Use: People, Environment and the State in New England, 1790-1930* (Oxford: Oxford University Press, 2001) p. 15

10 John Lauritz Larson, "A Bridge, a Dam, a River: Liberty and Innovation in the Early Republic," *Journal of the Early Republic* 7, no. 4 (December, 1987): 351–75; Jack Rakove, "The Origins of Judicial Review: A Plea for New Contexts" *Stanford Law Review* 49 (1996-1997): 1031-1064; Morton Horwitz, *The Transformation of American Law, 1780-1860* (Cambridge, Mass.: Harvard University Press, 1977) 1-4.

The intersections between these jurisdictional levels multiplied the paper trail following protests against the canal. At the same time, it also provided multiple forums for tackling the question of how the canal ought to operate. The proprietors faced repeated challenges to their management of the canal between their first meeting in 1790 and the sale of the canal to the Hadley Falls Company in 1845, and throughout this process, debates over the proper forum and means of dealing with the canal's operations persisted. These disagreements did not stop at the boundaries of the public sector, but insinuated themselves into discussions of the governance of the canal company. The proprietors existed as both a public entity—serving the need for improved transportation and facilitating growth in upstream towns—and as a private corporation—working to maintain profitability. At the same time, the question of whether the plaintiff ought to be the corporation or the managers appointed to run the canal on behalf of the proprietors reflected a secondary dimension to the uncertainties surrounding jurisdiction in this context.[11] Upstream landowners indicated this problem when they framed their suits as actions against the private managers operating the canal, rather than challenging the canal company as a whole.

At the same time, the details of their complaints described vivid memories of the issues that had fueled the initial decade and a half of litigation and legislative action surrounding the canal, which ultimately resulted in the removal of the proprietors' initial dam. During this time, the memory of this dam removal—and debates over its ultimate meaning—persisted in the state courts and legislature. Conflicts over the canal at South Hadley Falls concerned the historical memory of problems arising from previous canal designs rather than direct encounters with new

11James Willard Hurst, *The Legitimacy of the Business Corporation in the Law of the United States, 1780-1970* (Charlottesville: University Press of Virginia, 1970); Alfred D Chandler, *The Visible Hand: The Managerial Revolution in American Business* (Cambridge: Harvard University Press, 1977).

environmental issues. Rather than settling new points of law, these suits reiterated the problems that had been created by previous dams and demanded injunctions against the construction of new dams. Thus, the courts did not fulfill the role we are accustomed to assign them in deciding new points of law in a progressive and cumulative fashion. Instead, aggrieved upstream landowners used litigation as a means of preventing potential injuries by seeking to direct the construction of the dam and insisting on the continued force of preexisting judgments. In effect, these legal complaints against dam building became a political tool for something resembling a permitting process that gave the affected communities an opportunity to voice their concerns about the risks of dam building at South Hadley Falls. Thus, even the lawsuits against the dam resulted in dismissals and settlements played a key role in shaping the flow of water during the Early Republic because they utilized public memories of the harms done by previous structures to mitigate the potential harm done by new structures.[12]

During this time, the proprietors sought to maintain and expand the canal, responding flexibly to floods, droughts, disputes with shippers over tolls, and the growing scale of shipping running downstream. Ongoing pressure from shippers to enlarge the canal acted as a counterweight to pressure from upstream communities to keep the waterway small and minimize its impact on drainage and fisheries. These contrary pressures encouraged the development of specialized piloting teams that could guide heavily laden boats through the waterways surrounding the canal. The proprietors faced an impossible situation when managing the canal, anything that they did to improve shipping came at the cost of litigation from upstream

12 Austin Sarat and Thomas R. Kearns, eds., *History, Memory, and the Law* (Ann Arbor: University of Michigan Press, 1999); Horwitz, *The Transformation of American Law* 1-4; Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Cambridge: Cambridge University Press, 1990) 31-48.

landowners wary of their past environmental harm. In turn, anything done to mitigate that harm created bottlenecks for shipping. These difficulties did not reflect the particular haplessness of the canal's management, instead they reflected the uncertainties surrounding the operations of transportation companies in a society that had little precedent for building canals, managing corporations, or settling disputes over land use.

The business of canalling was a business of compromise. Between 1790 to 1828, the Proprietors of Locks and Canals built three iterations of the canal and dam complex. They faced three lawsuits challenging their rights to dam the Connecticut River. In the settlements of these lawsuits and the reengineering of the canal, we can see the patterns of an adversarial process of development, where legal mechanisms provided a means of regulating and adapting the operation of the canals and dams to the needs of upstream landowners while keeping their operations consistent with the needs of boatmen. While the lawsuits of upstream landowners would not prevent the construction or expansion of the South Hadley Canal, they did serve to regulate its design, facilitating compromise between the canal and neighboring communities while ensuring the preservation of the public's interests in the management of the waterway. The business of canalling was not a zero sum game. Despite the strength of the language used in complaints against the Proprietors, the lawsuits and legislative petitions designed to remove their dams resulted more often in compromise than intractable conflict.

Canal building, like the development of turnpikes, water power, and other infrastructure of internal improvement depended on the imprimatur of state legislatures and the settlement of legal conflicts in the courts. Law acted as an instrument of policy during the Early Republic as the states sponsored various corporations intended to foster internal improvements and economic development and the courts regulated the relationship between those corporations and the general public. Debates over the regulation of these privileges generally describes fiery rhetoric contained in the legal complaints and other public documents relating to improvement, but does not describe the array of compromises that made it possible to actually operate a canal.[13] Similarly, the engineering histories of canals tend to privilege their design and construction over the circumstances surrounding their operations, and when operations do come into focus, there is an inordinate focus on profitability rather than the environmental and social communities that these structures created.[14] This chapter explains not only the arguments surrounding the construction of the dams at South Hadley, but also how communities accommodated themselves to the operations of the canal and dam. Historical memories of water rights, fisheries, and meadowland management provided not only a basis for formulating complaints against dam building, but also a set of demands about the flow of water that could provide a basis for settling suits against the canal. This chapter explores the settlements reached by upstream communities.

The claims made against the canal, and the efforts of the Proprietors at meeting those claims, reflected the prioritization of personal relationships over impersonal market forces. The facilitation of commerce undoubtedly provided a priority in legal decisions and legislative agendas, but it did not provide the only means of determining policy outcomes. At the same time,

13 Cumbler, *Reasonable Use*.

14 Christopher F. Jones, "A Landscape of Energy Abundance: Anthracite Coal Canals and the Roots of American Fossil Fuel Dependence, 1820–1860," *Environmental History* 15, no. 3 (July 1, 2010): 449–84; Robert J. Kapsch, *The Potomac Canal: George Washington and the Waterway West*, 1st ed (Morgantown, W.V: West Virginia University Press, 2007); Williamson, "Inclined to Succeed: The South Hadley Canal," in *Waterways and Byways, 1600-1890*, ed. Peter Benes and Jane Montague Benes, Annual Proceedings (Dublin Seminar for New England Folklife) ; 2009 (Deerfield, Mass: Dublin Seminar for New England Folklife, 2014); Jill A. Hodnicki, *Locks, Stocks, and Barrels: The South Hadley Canal at 200 Years* (South Hadley, Mass: Mount Holyoke College Art Museum, 1996).

challenges in both the legal status of the canal and its day-to-day management prompted the appointment of an administrator able to keep the canal running and stand before juries and boatmen when faced with lawsuits and claims of damages. This was not a professional position, where the administrator pursued the interests of the canal company in exchange for a salary, but rather a position that allowed the administrator to align his property interests with those of the canal. In the perspective of the canal's more effective managers—not to mention its more effective challengers—the existence of a market depended on the establishment of reciprocal relationships grounded in personal trust.[15] These personal relationships proved importance because the South Hadley Canal sat not just in a single market—governing the shipping of goods through the Connecticut Valley—but also adjacent to markets in fisheries and meadowland farming, and participants in these rival markets effectively claimed historical precedence over the canal.

The First Canal, 1795-1805

In 1791, river shipping relied on agricultural laborers and their teams who were hired to cart cargoes around the falls. Their portage traversed log roads placed along a swampy shoreline teeming with mosquitoes. It added to the expense of shipping goods downstream and increased the amount of handling that cargo received, making accidental damage more likely.[16] In their petition for incorporation, the Proprietors envisioned a simple plan for improved navigation without understanding what the work of improvement entailed. They petitioned the General

15 Winifred Barr Rothenberg, *From Market-Places to a Market Economy: The Transformation of Rural Massachusetts, 1750-1850* (Chicago: University of Chicago Press, 1992); Christopher Clark, *The Roots of Rural Capitalism: Western Massachusetts, 1780-1860* (Ithaca: Cornell University Press, 1990).

16 Williamson, "Inclined to Succeed."

Court for a charter because they believed "that the transportation thro [sic] that part of Connecticut River which lies within the commonwealth is greatly obstructed by falls and rapids and on this account attended by heavy expenses. That great numbers of persons are constantly employed with teems [sic] at various carrying places whose labor would be much more useful in agriculture."[17] The petition argued that the canal would increase productivity by allowing these manual laborers and their teams to focus on agricultural work.[18] This logic addressed canal building in general, articulating a public interest that any member of the legislature could agree with, but provided little detail regarding how the canal would transform the local landscape and affect the public interest within its immediate vicinity.

The petition's denigration of the work of portaging cargo relative to agricultural labor reflected a broader sensibility regarding the proper forms of work in the society of the Early Republic. On the one hand, the growth of agriculture promised to benefit the valley by increasing trade and the demand for dry goods, increasing their availability and spurring the improvement of everything from roads to financial resources. Much like the bankers and businessmen described in Oscar Handlin's *Commonwealth*, who framed the case for urban and industrial growth in the Early Republic as a spur to agricultural improvement, the Proprietors of Locks and

17 Petition of the Proprietors of Locks and Canals, Acts of the General Court of the Commonwealth of Massachusetts (Mass. Acts) 1791 Ch. 32 passed 22 February 1792, Massachusetts State Archives (MSA) Boston.

18 The virtues attributed to agriculture in the Early Republic—and the concomitant denigration of commerce—are well documented. Drew McCoy, *The Elusive Republic: Political Economy in Jeffersonian America* (Chapel Hill: University of North Carolina Press, 1980); For an overview of what historians might miss by overemphasizing agrarian virtue see Michael Zakim, "The Business Clerk as Social Revolutionary: A Laboring History of the Nonproducing Classes" *Journal of the Early Republic* 26 no. 4 (Winter 2006): 563-603.

Canals understood their contribution to shipping as an element of rural development.[19] One correspondent to the *Connecticut Courant* insisted that the "towns which border on the river, and whose land is most feasible, are already considerably populous and have large quantities of produce for market. The *natural* course of trade from this country, is down Connecticut River; and the course which nature has prescribed, will be pursued."[20] The Patriot letters, as this correspondent's writing came to be known, lauded the construction of the South Hadley Canal among other improvements that would pull together natural advantages in trade that served the town of Hartford. In these accounts, the fulfillment of the promises of natural advantage, and the public good of increasing the number of farms upstream in the Connecticut Valley, created incentives for a range of developments including the locks and canals at South Hadley Falls and banks and wholesale merchants at Hartford. What this vision of economic development did not envision was the specific connections and accommodations that would prove necessary in order to fulfill the promises of development.[21]

Although the seal of the Proprietors of Locks and Canals advertised "Public and Private Good," some of their greatest challenges would come from lining up public and private interests. In their initial form, the Proprietors of Locks and Canals lacked any one individual who took responsibility for making sure that the design, maintenance, operations, financial solvency, and community standing of the canal remained in good order. The project attracted a number of

19 Oscar and Mary Flug Handlin, *Commonwealth: a Study of the Role of Government in the American Economy: Massachusetts, 1774-1861* (Cambridge: Harvard University Press, 1969).

20 "The Patriot No. II" *Connecticut Courant* (9 January 1792): 1.

21 Cathy Matson and Peter Onuf, *A Union of Interests: Political and economic Thought in Revolutionary America* (Lawrence: University Press of Kansas, 1990); William J. Novak, *The People's Welfare: Law and Regulation in Nineteenth-Century America* (Chapel Hill: University of North Carolina Press, 1996).

talented individuals, but their working practices overlapped little. This would result in conflicts when nobody working for the canal made a convincing case to upstream landowners for its operations being in the interest of the public at large. The proprietors took it for granted that the community would defer to and respect their agenda. Upstream landowners followed the corporation's lead, and focused their attention on the individual directors working on the canal rather than addressing their complaints toward the company as a whole. In this initial iteration, the boundary between public and private left individual proprietors working publicly while the corporation as a whole remained a private black box, within which the proprietors decided their strategies for engaging in the business of canalling.[22]

In their first step toward learning the business of canalling, the Proprietors contracted with Christopher Colles, a nationally known engineer, to survey the landscape of the falls. This proved a fateful choice because Colles' work set the agenda for the canal as it stood between 1795 and 1805. His analysis of the landscape would stand through this period causing many of the legal problems that accumulated during this first decade and persisted throughout the life of the canal. Colles had received his technical training in Ireland where he designed the customhouse in Limerick and served as the Director of Inland Navigation on the Shannon River before emigrating to the United States. and beginning an engineering career that would span forty years. In 1775, he helped to develop an aqueduct system for New York City. In 1785, he proposed a series of navigational improvements on the Mohawk River that would connect this tributary of the Hudson with Lake Oswego, and in a set of letters to George Washington he

22 These circumstances were consistent with the social atmosphere described in J. M. Opal, *Beyond the Farm: National Ambitions in Rural New England* (Philadelphia: University of Pennsylvania Press, 2008) 51-59.

proposed related plans for improving navigation on the Ohio. In 1789 he began publishing *A Survey of the Roads of the United States of America* which described the major arteries of the country in a series of small maps each representing one twelve mile stretch of road. At the same time, he campaigned for a national network of canals, which would be built aboveground in wooden frames rather than being excavated as ditches in the more traditional fashion. In this latter proposal he revealed something of his character as a designer as he believed that the plentiful supplies of timber in the United States would make it possible to build these canals of wood—like enormous intercity log flumes—rather than excavating channels in the ground. This easy faith in the availability of timber and concern about the difficulty of excavating channels would show through as his survey shaped designs for the South Hadley Canal.[23]

Colles surveyed the geology and landscape of the South Hadley Falls, identifying several obstacles that would shape the design of the canal. His assessments of the riverbanks surrounding the canal suggested that they were "too hard to be easily dug and too loose to be blown."[24] Thus, he explained to the proprietors that they would need to use a relatively high dam in conjunction with a shallowly dug canal. This would make it possible to establish the canal's channel by partitioning a portion of the riverbanks off from the stream rather than excavating a channel below the level of the stream. To block off the whole length of the rapids and pool the maximum amount of water, Colles' survey laid out a dam that followed a shelf of rocks that proceeded about halfway across the river before turning downstream and meeting the banks

23 Deborah Popper, "Poor Christopher Colles: An Innovator's Obstacles in Early America" *Journal of American Culture* 22 no. 2 (June 2005): 178-190; The Metropolitan Museum of Art owns An 1812 portrait of Christopher Colles by James Frothingham, http://www.metmuseum.org/collection/the-collection-online/search/10919;

24 Dwight, *Travels,* I:323

about a quarter mile from its start. In essence, Colles envisioned working around the channel's geology. By detailing the difficulties of modifying the geology of the river Colles emphasized the greater ease of modifying the timing of water's flow through the falls, and the proprietors would try this tactic during the next decade.[25]

Benjamin Prescott, himself a proprietor and a participant in the survey of the canal, designed and engineered a structure that largely followed Colles' approach to the landscape. He suggested the use of an inclined plane to move boats down the fifty foot drop that constituted the heart of the falls. Approaching the inclined plane, a boat traveling downstream entered a modified lock—essentially a sixty-foot by fifteen-foot tub set on enormous wheels—that allowed it to roll up and down the ramp. Once the boat entered the lock, the lock tender drained the water and engaged a water powered winch to slowly lower the cart—now holding the raft—down a ramp fifty-three feet tall and two hundred and twenty-three feet long. At the foot of the inclined plane, the boat entered another lock, which released it into the Willimansett rapids. These next rapids dropped approximately eight feet in the space of a mile, still running between the same red sandstone bluffs as described above, but sixty feet closer to sea level.[26]

In this initial design, the canal depended on access to cheap lumber and the availability of specialized mechanics who could maintain its works. Colles and Prescott made this choice so as to avoid the expenses and inconveniences of excavating a deeper canal in the sandstone bluffs

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25 "Chris. Colles' Work on the Canal" 24 May 1792 L&C I-2,a

26 Timothy Dwight, *Travels in New England and New York* (London: Baynes, 1823; Cambridge, Mass.: Harvard University Press, 1968) 1:287 described the canal; William Trowbridge, *Water Power in the United States* Tenth U.S. Census v. 16 (Washington D.C.: Government Printing Office, 1880) p. 51 briefly describes the underlying geology of the falls; Robert Fulton, *A Treatise on the Improvement of Canal Navigation* (London: I. and J. Taylor, 1796) 71-76 described the design of an inclined plane similar to that used by the South Hadley Canal.

adjoining the river. Financially, they committed the proprietors to an ongoing array of maintenance expenses connected with wood construction so as to save the initial expense of building in stone. Environmentally, this approach would have three consequences that shaped the first decade of the canal's operations. First, trees might have been plentiful, but the availability of lumber in volumes necessary to repair or maintain the dam and canal depended on its careful acquisition and preparation. Second, episodic flooding and regular rainfall hastened the decomposition of the lumber used in the dam, the canal, and the machinery operating the canal, ultimately raising the expense of operations.[27] Third, by investing in a higher dam to work with what Colles thought were the advantages of the landscape, the proprietors brought themselves into conflict with upstream landowners whose land became subject to flooding and whose fishing places became barren.

The canal proprietors' responses to protest reflected ongoing issues with accountability and management. Individuals working on the canal took discrete responsibilities, but nobody took responsibility for the canal as a whole. Colles surveyed the canal, Prescott designed it, and initially Elisha Mack was going to build it. Unfortunately for Mack, the freshets of March 1794 washed out the dam he had built and sent the lumber that he had used in building it downstream with little hope of recovery. Mack complained to the proprietors that the flooding that washed out the dam also crippled his ability to make good the damages—as the dam did not represent the only lumber washed downstream, and consequently the prices for its replacement exceeded Mack's available credit. In the first stages of executing Colles and Prescott's plan, the realities of

27 Brook Hindle ed., *Material Culture of the Wooden Age* (Tarrytown, NY: Sleepy Hollow Press, 1981); Hindle, *America's Wooden Age: Aspects of its Early Technology* (Tarrytown: Sleepy Hollow Press, 1975); Popper, "Poor Christopher Colles."

the lumber market did not measure up to their vision of the abundance of timber. The Proprietors held fast to their design and sued Mack for his unfulfilled contract.[28]

After Mack's experience with dam failure, Benjamin Prescott took over construction. Working during the low water of summer 1794, he completed the dam on September thirtieth of that year. The first boat passed through the locks on December twenty-fourth.[29] The spring freshets in 1795 left Prescott's dam in place, and the canal began its first season of operation. For the remainder of the eighteenth century, Prescott also served as the superintendent for the canal, working in concert with the proprietors and representatives from the boatmen navigating the river to pull its operations into shape. Initially, the position of superintendent acted as an on-site manager paid to ensure the operations of the canal proceeded smoothly. Prescott's expenses and his decisions regarding the design and operation of the works were regularly subject to the review of the Proprietors as a body. This would have significant consequences when upstream landowners appealed for the payment of damages to their land and when questions of the canal's maintenance arose. The superintendent developed the closest knowledge of the local environment but lacked the financial autonomy necessary to direct efforts at adapting the canal and dam to that environment.

28 "Proceedings of a Meeting of the Proprietors of Locks and Canals." 27 June 1793 L&C L-2,f established the contract with Elisha Mack; Elisha Mack to Proprietors, Letter, 1 April 1794, L&C N-2,f described the effect of the freshet on his efforts at building the dam; 3 June 1795, L&C M-3,27 discussed the settlement of their lawsuit against Mack; The conflict is also mentioned in Dwight, *Travels* I:235.

29 The dam date comes from Jonathan Strong v. Jonathan Dwight and Justin Ely, 7 September 1801, Hampshire County Superior Court Proceedings v. 19, microfilm, University of Massachusetts Special Collections and Archives (Umass) Amherst, Mass.; the canal date comes from "Extract of a Letter" 12 January 1795.

As the canal began its first years of operation, Prescott worked with the board of directors to settle an array of tasks that improved conditions for boatmen. The main thrust of his interactions with the directors involved efforts at ensuring that the experience of travel through the canal remained predictable and efficient. Prescott accepted the directors' oversight for the enlargement the reservoir that powered the winch for the inclined plane, making it possible to pass more cargo through the canal during peak traffic. He also oversaw, in conjunction with the directors, the development of methods for estimating the weights of different freight goods. While the charter for the corporation established a schedule of tolls, the speedy passage of cargo through the canal depended on the ease of establishing and negotiating toll rates. Being able to post a standardized table from which tolls would be calculated provided a transparent means for shippers to understand their costs. Finally, he gained the authority to settle and pay claims for damages to shipping. Prescott managed the canal system with an eye toward communicating competency—if not expertise—to the boatmen traveling through its locks. By assessing the weight of cargo by sight, adapting the works to accommodate shipping at its observed peak volumes, and establishing a means to settle claims for damages when boats did founder, the Proprietors showed some flexibility in dealing with their customer base.[30]

The Proprietors' flexibility in dealing with boatmen resulted from the difficulty of differentiating between natural accidents and poor piloting in assessing damage claims. Damages to shipping on the canal could be attributed to a number of factors including a shortage of water that delayed travel through the canal or the errors of pilots guiding boats through the locks and over the rapids. In 1795 and 1796 the board of directors personally investigated claims for

30 Minutes of Proceedings, 6-8 April 1796, L&C, M-1,p Document A.

damages and proved reluctant to pay out settlements for aggrieved boatmen. Joseph Mayo approached the canal with a raft carrying 236 tierces of flax (approximately 9440 pounds). According to John Bennett, a shipper who appears to have acted as an intermediary between the boatmen and the Proprietors, when Mayo had gotten his rafts "down to the reservoir by the machine, there was water enough, but some evel [sic] minded person took away the sham dam and let the water so that it put it out of power to opperate [sic] with the machine. He then left his raft and went home. We got the water in so as to opperate [sic] in four day, but he did not return till about six weeks after."[31] Mayo would have had a strong case had he remained in the vicinity with his hands and waited for safe passage, but the Proprietors concluded that his decision to return to his home in Montague had caused the lion's share of the damages, as while he was away the rafts only gradually began to leak, damaging his large load of flax.

By contrast, the Proprietors proved far more receptive to the claims of Daniel Martins, whose boat carrying approximately eight tons of rock salt wrecked while moored in a guard lock overnight awaiting the passage of a rainstorm. A jammed wicket gate, which would otherwise have permitted drainage, caused the guard lock to overflow. As a result, the bow of the boat floated over the wall of the lock onto an adjacent platform, which pushed the stern down into the basin and began to fill that end of the boat with water. Captain Martins and the pilot Joseph Allen —who had been waiting out the storm in a nearby tavern—found the wreckage in the morning, and guided the boat back into the water. They bailed it out and removed its contents to be dried out, but upon completing this salvage operation, Martins and Allen discovered that

31 John Bennett "Statement Respecting Mayo's Cask" n.d., M-2,27, L&C (this was certainly written between 1795-1800, and was likely written early in the period because the rules respecting damage claims became clearer over time. The conversion of tierces to pounds comes from "Meeting of Proprietors" 24 March/30 April 1795, L&C M-1,q

approximately 2400 pounds of salt had washed downstream. When faced with this specific loss, the Proprietors found it easier to approve the payment of damages because the captain and the pilot had cooperated in efforts at protecting the boat and minimizing damages to its cargo after its injury.[32]

The payment of damages reflected a broader recognition that the canal had not eliminated the need for specialized labor to ship goods around the rapids. A lock tender and pilots employed by the proprietors remained necessary to navigate the canal. Moreover, for much of the year, another pilot and additional crews of supplemental laborers proved necessary to assist boats in their navigation of Willimansett Rapids. Here, the river dropped about eight feet in the course of a mile and it proved navigable, but only with the assistance of laborers and teams of oxen who could haul the boat out of eddies and off shoals. The Proprietors initially built a canal running along the east bank of the stream, but found that runoff from the land eroded the banks and rendered this course unusable.[33] As a consequence, the Proprietors resolved to contract with pilots who would develop the specialized knowledge necessary to navigate this specific reach of the river. These company-employed pilots were empowered to issue orders to the boatmen carrying their vessels through the canal and down the rapids, including orders to hire extra hands to ensure safety in negotiating the eddies created by the passage of water over the dam. While the Proprietors guaranteed the expertise of their pilots, they also admitted that experienced boatmen might not need this assistance, and any boatman negotiating the rapids and the locks on their own assumed responsibility for damages to their cargo or their crew's safety in exchange for a

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32 "Memo of Salt Damaged at Willimansett" 17 August 1800, M-3,unlabeled L&C

33 *Two Reports Made by the Directors of the Committee to Improve Navigation on Connecticut River* (Hartford: P.B. Goodsell, 1825) p. 8.

discount in tolls. The Proprietors publicized their willingness to pay reasonable damages so long as boatmen did not attempt to come downstream overloaded, shorthanded, or aloof of the directions issued by pilots.[34] The extra hands and pilots who assisted boatmen navigating reaches of the river surrounding canal indicated the continuing need for workers helping to move cargo past South Hadley Falls, a blow to the proprietors argument in their petition for incorporation, where they presented the canal as a means of freeing up local laborers for work in agriculture.[35] Perhaps unsurprisingly, such arguments never arose again in debates over the public utility of the canal. In a broader sense, the demands of pilotage reflected the continuing power of nature over human uses of the river in spite of the Proprietors' attempts to smooth over navigational challenges in a canalized landscape.

Alternatives to the canal lived on in public memory even if they were never put into practice. Boatmen threatened to go back to carting their cargoes around the falls as they worked to negotiate reduced tolls for passage through the canal. In letters and petitions before the Proprietors as early as April 1796, James Utley argued that tolls ought not to apply to the weight of the boats themselves when boatmen floated five or more tons of cargo through the locks. John Bennett repeated this sentiment in an addendum to his statement on damages to John Mayo's flax.[36] The proprietors approved this proposal in late August 1796 at the same time that they approved a decision to delegate to Bennett responsibility for negotiating the a discount to

34 Minutes of Proceedings, n.d. (likely 1796 because it fits with the discussion of superintendency and discusses making provisions for pilotage.), M-1, unlabeled, L&C.

35 Petition of the Proprietors, 1792.

36 "Proposal of James Utley" 7 April 1796, M-2,e, L&C; a similar proposal is included in a postscript to John Bennett "Statement Regarding Mayo's cask," reinforcing my contention that this claim dates to early 1796.

boatmen who drew their own cargo up Willimansett rather than relying on the supervision of a pilot.[37] These protests provided a reminder that the canal depended on its largest shippers to turn its greatest profits, and also the degree to which a desire to attract larger shipping, with an enlarged canal, would continue to weigh on the minds and ambitions of the canal's superintendents.

Figures such as Prescott and Bennett played a key role in getting the canal built and facilitating its operational relationship with the boatmen. This is interesting because studies of the reputations of canal proprietors mention Prescott's relative lack of prominence as a public figure and in the interconnected genealogies that characterized many of the other proprietors.[38] Arguably, he was a working partner in the management of the river. Such work played a key role in guaranteeing the revenue that made the canal viable and provided specifications for how the canal ought to facilitate navigation over the three miles of river that it improved. Prescott, who supervised the operation of the locks and inclined plane, and Bennett, himself a boatman, traveled up and down the river and negotiating problems with tolls, damages to freight, and disputes over pilotage. These figures made the canal work, learning many key early lessons in the business of canalling, but not wholly adapting the canal to its landscape. Their position, secure though it seemed, focused almost exclusively on operations through the South Hadley Falls. It failed to account for the difficulties that their dam caused upstream in the meadows of Northampton, Easthampton, and Hadley. While the proprietors operated a company that

37 Minutes of Proceedings, 6 January 1796, M-3,21, L&C.

38 Jill A. Hodnicki, *Locks, Stocks, and Barrels: The South Hadley Canal at 200 Years* (South Hadley, Mass: Mount Holyoke College Art Museum, 1996) contains short biographies of the proprietors noting their genealogical connections and overall wealth.

responded quickly to the needs of its customers, their relationship with the upstream communities affected by the dam's flooding remained more complicated.

Meadows and Fisheries

The proprietors encountered difficulties with upstream communities because their dam flooded agricultural land, eliminated fisheries, and left behind decomposing vegetable refuse whose effluvia were thought to cause disease. The proprietors and their upstream neighbors left a remarkable number of petitions, remonstrances, and legal filings about these issues given the surprising consensus between the proprietors and upstream land owners between 1795 and 1805 regarding the damages caused by the dam. Much of this paper trail concerns a related conflict between these parties over whether it was legal to build a dam in the first place. This contrast between the agreement on direct ecological issues at hand and the legal conflict over how to solve this problem reflected a broader dispute over whether the proprietors had a right to build any dam whatsoever. This would persist throughout the Canal's period of operation, and colored many of the debates over what to do about the immediate nuisances created by the dam. This simultaneous attention to the immediate issues raised by the dam, and the long range precedents that a hasty solution to these issues might create, extended the debate over the dam's removal. The tension between these issues also served to mask the benefits that accrued to the proprietors in their removal of the dam.

The dam at South Hadley Falls effectively delayed the beginning of spring for upstream farmers by holding back floodwaters on their land. It eliminated spring for fishermen who depended on migratory species. It extended the period of flooding resulting from the spring freshets, and prevented the fish from ascending the stream. When Epaphras Hoyt, who will be familiar from the previous chapter's discussion of his role investigating the reengineering of the Agawam River in 1805, investigated the impact of the South Hadley Canal under a similar remit, he noted that "water continues on the meadows in spring about three weeks longer than it formerly did"[39] an assessment of flooding that emphasized its seasonal nature. Indeed, households living along tributary streams such as the Mill and Lickingwater (Manhan) Rivers complained that, "a small rise of water in said [Connecticut] river overflows a considerable portion of lands in the southern part of Northampton Meadows."[40] The rise in the water did not directly and permanently inundate much land, but it transformed the pace of drainage, and reduced the tolerance for flooding built into the landscape. The rising height of floodwaters rendered the decades of previous interventions to drain the swampy meadows ineffective and largely moot. Farming practices of meadowland owners in towns like Northampton, Easthampton, and Hadley entailed plowing up riverine meadows immediately after the recession of the spring floods. David Hoyt, a farmer on Deerfield Meadows, whose concerns were mentioned in the first chapter, complained of even a one or two week delay in plowing caused by unexpected high water, indicating that a three week delay would be doubly intolerable, particularly as a late beginning to the growing season might mean extended exposure to dry air and the potential for storms during the ordinary period of harvest.

The dam did not distribute its floods evenly across the floodplain. Accounts of wet meadow farming in New England universally emphasize the minimal tolerance for drainage

39 "Report of the Committee Sent to Northampton to Investigate Complaints of Illness" 1801 Sen. Bill 2748 Doc. 3, Unpassed Legislation, MSA.

40 "Petition to the Proprietors of Locks and Canals" 6 July 1799, L&C M-3,16; Nathaniel Shaler "General Account of the Fresh-Water Morasses of the United States" in the Tenth Annual Report of the Director, United States Geological Survey (Washington, D.C.: Government Printing Office, 1890) p. 308, Google Books.

issues.[41] Raising the baseline water level by four feet at the base of the dam would have transformed the river along most of the thirty-five-mile long string of meadowland between South Hadley Falls and Turners Falls, a reach where the river rose only five feet. At the same time, the riverine landscape north of Mount Holyoke consisted of natural levees along the riverbanks, which were in the process of growing into full fledged terraces, and a slow decline in elevation leading toward the uplands, creating landscapes with the potential to become backswamps as much as a mile inland from the riverbanks. The tributary streams running through the meadows moved from relative lowland into and through the river terraces, cutting a channel through the natural levee that ordinarily flowed downstream, but changed course and ran upstream when the Connecticut flooded. In Northampton, Hadley, and Easthampton this meant that flooding along Connecticut River got to its worst point almost a mile inland from the riverbank where ponds and tributary streams entered the uplands, rather than directly along the banks of the stream. This geographical detail helps to explain how towns such as Northampton, Easthampton, and Hadley, whose houselots mostly sat inland from the riverbank, experienced the extended flooding of the dam so viscerally.

The poor drainage caused by the dam coincided with outbreaks of disease in Northampton and Easthampton. Local residents, the proprietors themselves, and the committee sent by the state legislature to investigate the dam all attributed the outbreaks to the extended periods of high water. Medical authorities and popular wisdom believed that the decomposition of flooded plant matter was one cause of the fevers and ague identified in petitions. Although the

41 Brian Donahue, "'Dammed at Both Ends and Cursed in the Middle:' The 'Flowage' of the Concord River Meadows, 1798 - 1862," *Environmental Review: ER* 13, no. 3/4 (October 1, 1989): 47–67; Idem. *The Great Meadow: Farmers and the Land in Colonial Concord* (New Haven: Yale University Press, 2004); Steinberg, *Nature Incorporated*.

proprietors faced indictments for causing increased disease with their dam and public perceptions certainly attributed the increasing prevalence of ague to their presence, it is not clear that they can be held responsible in light of modern biology. Indeed, despite the testimony of numerous residents of the affected towns, it seems likely that an increase in disease during the period from 1796-1805 resulted from an unknown vector. Joseph Lathrop described a similar increase in disease five miles downstream from the dam in the first parish of West Springfield, indicating that some factor other than the construction of a dam at South Hadley caused the uptick in the incidence of disease. Improvements of drainage in the region reduced the amount of land covered by flood-tolerant flora, so when a dam raised the overall water level during the spring thaw, floodwaters drowned these plants and exacerbated the processes of decomposition following the relatively instantaneous flooding of lowlands. In the etiology of disease current at the time, such decomposition released miasma that caused illness. Medical case studies current during the early nineteenth century reported a popular sense that plant decomposition fouled the air and increased the prevalence of disease, but they also acknowledged the skepticism of many dam owners regarding the perniciousness of their works.[42]

The consensus about the relationship between the dam and increasing levels of illness followed from the effective collection of health records in the affected towns. Local residents collected data on the number of sicknesses in individual households surrounding the dam and included this data in their petitions for the dam's removal. Residents in these low lying villages

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42 Dwight, *Travels*, 236n; David Daggett, "A Brief Account of a Trial at Law, in which the Influence of Water Raised by a Mill-Dam, on the Health of Inhabitants in the Neighborhood, was Considered" *Connecticut Academy of Arts and Sciences, Memoirs* 1 no. 1 (1810): 131-134, which describes a trial under similar circumstances in New Milford, Connecticut where the defendants had destroyed a dam alleged to raise bilious humors in January 1799.

and neighborhoods testified that sickness during the summer remained unknown for at least fifty years before the construction of the dam, but after its completion, they documented 3-5 cases of unseasonable illness per household.[43] These statistics, like the health statistics included in topographical studies of towns and cities that were often published in the Early Republic, sought to document unusual cases of what they referred to as fever and ague occurring during the summer season. In this approach, it likely proved as important to the outcome of their petitions that residents could credibly testify that there had been little disease in the countryside during the half century preceding the construction of the dam. A similar case filed in New Milford, Connecticut in 1799—where a mill dam owner sued local residents for tearing down his structure on account of an increase in disease during the preceding three years—resulted in a finding for the dam owner on account of the plurality of causes that could have contributed to the disease outbreak. The proprietors could easily have contested claims that their structures caused such outbreaks. This raises the question of why the proprietors so readily agreed that their dam posed a disease risk, a question that will be addressed after noting how the dam reshaped fisheries.

Petitions for damages to fisheries treated the harm caused by the dam as an offense against both their petitioners' livelihoods and the public good at large. Because property boundaries ran to the centerline of the river, fisheries in the Connecticut Valley belonged to

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43 These statistics are drawn from 1801 S 2748 docs 21 and 19 MSA; observations confirmed or repeated in "Report of the Committee Sent to Northampton to Investigate Complaints of Illness" Senate Unpassed Legislation 1801 packet 2748 doc. 1 MSA Petition to Proprietors of Locks and Canals, 6 July 1799, M-3,16 L&C also outlined the increasing incidence of fever and ague; Oz Frankel, *States of Inquiry: Social Investigations and Print Culture in Nineteenth-Century Britain and the United States*, New Studies in American Intellectual and Cultural History (Baltimore, Md: Johns Hopkins University Press, 2006); Andrew J. Lewis, *A Democracy of Facts: Natural History in the Early Republic*, Early American Studies (Philadelphia: University of Pennsylvania Press, 2011); Conevery Bolton Valenčius, *The Health of the Country: How American Settlers Understood Themselves and Their Land* (New York: Basic Books, 2002).

landowners who abutted particularly productive fishing holes. Because these holes often occurred along meadows, which were themselves under collective management by proprietary groups of landowners the fishing holes were managed by teams of fishermen. The proprietors of these fisheries cleared brush and other obstructions that might have impeded seining, and helped to develop pools in which fish such as shad would congregate. In the opinion of one fishery proprietor working downstream at Agawam Meadow, the confluence between the Connecticut and a tributary provided a place where "the opposing currents have formed a bay or cove, which serves as a temporary resting place for shad and other fish when ascending the Connecticut River."[44] The best fisheries on the Connecticut occurred at the points where the current of incoming tributary streams created turbulence and fostered the development of slackwater eddies where the shad could rest on the way upstream. The three surviving petitions, addressed to the canal company by the Proprietors of Marshall's Fishing Place, the Old Rainbow Fishery, and the Hockanum Fishery [see map] outlined the financial loss from the changed hydrology that accrued to these landowners, but also described the larger damage to the public good when this nutritious and culturally desirable food source disappeared. Fishermen's estimates of the financial losses caused by the dam to seven hundred dollars between the three locations—each of whose fishing seasons were undone by the dam starting in 1795 and would continue to face damages until 1804—across this period, the Proprietors were charged with causing a grand total of seven thousand dollars in damages. This may not have been beyond the means of the corporation in the strictest sense of the term, but it did cost more than the Proprietors of Locks

44 Gad Warriner, Petition to Reinstate the Agawam Fishery; An interview with Willy Bemis in John McPhee, *The Founding Fish* (New York: Farrar, Strauss & Giroux, 2004) directly praised the old oxbow lakes of Northampton and Easthampton as excellent spawning grounds. See also, map http://tinyurl.com/ofdp4tc.

and Canals wished to pay.[45] Claims against the Proprietors amounted to more than money, they also amounted to debates over what actually constituted the public good. Did the public have a greater interest in the trade facilitated by the canal or in the fish migrations that the canal interrupted? The answer to this question went beyond matters of dollars and cents to incorporate the question of whether the festivities associated with spring fish migrations mattered more than the mercantile benefits provided by the canal.

The Proprietors initially sought to forestall payments on fisheries by denying that they caused any harm. Before even considering the means by which they might settle the case against them, indeed before fishermen filed their first formal petitions for damages, the canal company was collecting depositions from fishermen in Connecticut testifying to the generalized decline of the fishery.[46] Even as the Proprietors sought to prove that the fishery on the Connecticut declined for a variety of reasons, they simultaneously sought legislation that would prevent the taking of fish at the foot of the dam, indicating that they did believe that a sufficient fishery existed on the Connecticut to be worth their own investment. Moreover, the reports of local geographies published around the turn of the century describe a network of fishing weirs at the foot of the dam, which would have been constructed under the license of the canal company. In light of this side business, denying the harm that the dam did to fisheries became untenable.[47]

The proprietors approach to dealing with land damages also showed conflicts between their public and private statements. Stockholders whose land was flooded by the dam received

45 Old Rainbow Fishery Petition for Damages, M-3,11 L&C; Hockanum Fishery Petition for Damages, M-3,12 L&C; Nathan Marshall's Petition for Damages to Fishery December 1796, M-2,b, L&C; McPhee, *The Founding Fish.*

46 "Testimony of Elisha Shephard on the Decline of Shad and Salmon" 26 January 1796, L-1,q, L&C;

compensatory damages between 1794 and 1803, but the proprietors temporized on claims for damages to land flowed and fisheries destroyed when they did not belong to stockholders. Early filings for damages by stockholders in the canal who lived upstream—such as treasurer Samuel Henshaw or stockholder Levi Shephard—received payment promptly.[48] By contrast, Josiah White, a landowner in Northampton who found his land flowed noted that he had made repeated applications for damages to the Proprietors. White only received his payment after he enlisted John Bennett, who worked to facilitate relations with shippers, to advocate on his behalf. Bennett's experience advocating on behalf of boatmen who shipped goods downstream made him an ideal candidate for advocating on behalf of landowners, but it also left many of White's neighbors uncompensated for their damages.[49] This discrimination ran against the provisions for damage payments in the Proprietors' charter and indicated the admixture of public and private in the management of the canal at South Hadley Falls.[50]

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47 Minutes of Proceedings 24 December 1792 M-1,r L&C expressed concern that fishermen would exploit the dam upon its opening years before the dam was even built. Minuted of Proceedings 6 April 1797 M-1 unlabeled L&C authorized the superintendent of the dam to intervene with fishermen at the foot of the dam; A draft bill in the Proprietors records indicates that proposed legislation to regulate fisheries explicitly made no comment on the legality of the dam "Act to Prevent the Taking of Fish Near the Dam at the Canal at South Hadley M-1,a L&C; Jedediah Morse, *American Universal Geography* 389 described the wharves extant in 1805.

48 Minutes of Proceedings, 16 January 1795, M-3,25 L&C contains Henshaw's claim; Minutes of Proceedings 13 July 1796, M-2,z L&C contains an approval of the claims of Levi Shephard. Henshaw and Shephard are noted in the Articles of Incorporation, Massachusetts Acts, 1791 Ch. 32, and the subsequent establishment of a committee to meet with the residents of Northampton, 1797.

49 Josiah White "Claim for Damages by Flowing" 13 January 1796 passed to Bennett for delivery 6 April 1796, L&C I-2,j; "Minutes of Proceedings" 6 April 1796, L&C M-3 (22) contains the approval of White's claim; John Bennett, Statement Respecting Mayo's Casks, M-2,27

50 *Acts and Resolves*, 1791, Ch. 32 p. 304.

The proprietors took advantage of a weak legal position to improve their financial position. To begin this process, they hid their assets. The company claimed that they had never seen the profits necessary to pay dividends to their shareholders, and that the shareholders themselves were burdened by an unending series of assessments. This claim appears literally true according to the accounts, but only because the Proprietors worked to engineer a lack of profits. During a meeting in June 1802, even as they were planning to lower the dam in response to a suit brought by upstream landowners, the Proprietors also decided to issue loans with any income not already committed to paying for operations and expenses, effectively hiding their profits just before telling the state legislature that they had never turned the profits necessary to pay dividends.[51] The canal company claimed to be cash poor because of misfortune, but actually their directors put a great deal of work into cultivating the image of poverty. This pose of victimhood made it possible for the Proprietors to concede the damages wrought by the dam while continuing to negotiate with aggrieved neighbors. A company with few profits makes an unattractive target for lawsuits regardless of their merits because an award of damages is only as valuable as the credit and assets possessed by the guilty party.

In September 1800, the proprietors hired Epaphras Hoyt to survey the canal and report on a strategy for lowering the dam. His report, privately issued to stockholders, indicated that the decomposition of the dam and inclined plane would require the removal of the dam and deepening of the canal. The Proprietors had been negotiating settlements with aggrieved landowners since 1797, but until 1800, the complaints of the landowners proved ineffective. The timing of the Proprietors' about-face was interesting. On 22 October 1800, the directors received

51 Minutes of Proceedings 16 June 1802, M-3,28 L&C.

a report from Hoyt concluding that "the bed of the canal from blast rock to the inclined plane ought at least for some part of the way to be lowered—the machinery of the inclined plane is decaying and unless locks are made in season great interruptions will be occasioned."[52] This study, conducted independent of the Proprietors negotiations concerned only the financial interests of the corporation, which stood with the removal of the dam. Indeed, it remains something of a mystery why the proprietors remained in legal conflict with upstream landowners during the next two years if they already understood the necessity of replacing their works. They could have admitted that the inclined plane and the eleven-foot dam would need to be taken down before John Strong's lawsuit against the corporation arguing for that course of action would be decided at the May, 1801 session of the County Court. They even could have admitted this fact before the Supreme Judicial Court rejected their appeal in May, 1803. Interestingly, this report was also circulated before the company was willing to negotiate in depth on the petitions of the fisheries operators, and before the state went to the trouble of collecting evidence that the dam proved a threat to public health.[53]

The proprietors maintained a complex and ultimately effective legal charade. They established their lack of liquidity so as to avoid paying cash settlements. At the same time, they continued to maintain a slowly rotting canal that would require replacement, admitting the charges against this structure, but also maintaining that they lacked the resources to replace it. As they researched plans to deepen the canal and remove the dam, the General Court appointed a

52 "Report of a Committee of the Proprietors of Locks and Canals Respecting Alterations to the Canal" 22 October 1800, Mass. Acts, 1804, Chapter 77 "Making a Temporary Alteration in the Toll Received by the Proprietors…" Doc. 12 MSA; Minutes of Proprietors, 12 July 1797 M-1,m L&C.

53 Strong v. Ely (1800); Ely v. Strong, Supreme Judicial Court Records (1803) p. 500 Hampshire County Court Archives, Umass.

committee to travel to Northampton, investigate conditions upstream of the dam, and intervene in negotiations over its replacement or renovation.[54] On the face of it, this committee provided a neutral arbiter in the dispute between residents of upstream towns and the Proprietors at South Hadley. Contemporary public accounts of the conflict, such as the geographical writings of Timothy Dwight and Jedediah Morse, treat the establishment of the General Court's committee as a moment where the Proprietors bowed to public pressure and worked to redesign their canal so that it no longer caused disease, destroyed fisheries, and flooded meadowlands—giving up the inclined plane, a triumph of engineering, in the process.[55] The private records of the Proprietors, however, suggest that they cultivated this image of defeat for the benefit of their corporation.

Hoyt's appearance in both the survey of the condition of the inclined plane in 1800 and in the investigation of the canal in 1801 suggests a conflict of interest. There are other possible explanations. We might conclude that his appointment reflected the rarity of such conveniently located talent rather than the conscious exploitation of a conflict of interest. Nevertheless, the fact remains that the Proprietors proved highly politically astute in their arrangement of finances and it is likely that they understood that having their grievances aired in front of a commission that included a business partner would help to improve their case. The ultimate question is not a moral one, but one of how the coziness between the company and the legislators sent to regulate

54 Appointing Agents to Repair to Northampton and South Hadley Falls and Report Back in the First Week of the First Session of the Next General Court" Mass. Acts, 1800 Ch. 134 passed March 1801; Rodolphus Dickinson and Epaphras Hoyt, *Elements of Geography*, (Boston: Bradford and Read, 1813); Hoyt's biography appears in Malcolm Stearns, *Epaphras Hoyt: Public Servant* typescript, Historic Deerfield Library, 1931; Minutes of Proceedings 11 September 1800, M-3,29 described the hiring of Hoyt to survey the canal.

55 Timothy Dwight, *Travels*, I:324; Jedediah Morse, *American Universal Geography* fifth edition (Boston: Thomas and Andrews, 1805) p. 380-403; Morse and Dwight provided the evidence for analysis by Jon Cumbler in *Reasonable Use.*

it changed environmental outcomes. Hoyt's work in surveying the canal, identifying the changes necessary because of its faulty construction, and then framing of the decision against the proprietors so as to ensure their financial stability meant that questions about the dam's fundamental legality took a back seat to the immediate necessity of redesigning the canal.

Both the proprietors and the upstream landowners guarded their positions regarding the legality of the dam even as they sought its replacement. In 1801, the people of Northampton had instructed their state representative, John Taylor, to actively negotiate the settlement of the dam case without admitting that the dam was legal.[56] Meanwhile, the proprietors themselves devoted extensive space in their petitions for financial assistance in rebuilding the dam to the legality of building dams in general. They maintained that "leave to build the dam was clearly granted, because in and by the act of incorporation the proprietors were requested to erect, keep up, and forever maintain such dams, canal, and locks as the rafts and floats of timber might pass down and boats and other craft might safely pass up the river."[57] This question would persist throughout the subsequent decades even as the definitions of the public benefit attaching to the dam were transformed.

While the Proprietors private records indicated that they needed to replace the dam and the inclined plane and that they might actually have the revenues to complete this task, their responses to petitions and resolutions aimed at characterizing the dam as a nuisance served to turn the replacement of the dam into a publicly funded project. The proprietors presented their work as an object of the public interest that had become a public nuisance, necessitating state

56 "Instructions of the Town Meeting of Northampton to Representative John Taylor" 1801 S. Doc 2748 no 17 MSA.

57 "Petition of Proprietors Applying for Assistance in Removing the Dam" Mass Acts, 1801 Ch. 48 Doc. 2 MSA

financing for its repair and replacement. Remember that while the proprietors had decided to lend out their surplus revenues at interest rather than redistributing them as dividends, they also provided accounts to the state government claiming that they had never seen a profit. In using insider knowledge to create an impression of a company facing penury and failure to instigate a more favorable settlement of damages, the Proprietors managed to avoid responsibility for the worst of the losses associated with the financial burden of redesigning the dam. On 25 February 1802, the General Court passed a bill granting a lottery to raise up to 20,000 dollars to pay for the rebuilding of the dam. One quarter of the tickets—and their attendant revenues—were given to the towns upstream to pay damages to upstream landowners, while the revenues from the remainder of the tickets went to pay for the replacement of the dam itself.

The lottery effectively cancelled the claims held against the proprietors for damages. Paid in full, these damages would have proved quite substantial. If we return to the claims for damages listed above, it becomes clear that the damages to fisheries alone would have cost 5600 dollars for the eight years during which the inclined plane operated. The damages to Josiah White's land cost thirty dollars for a single year—indicating that his damages would have amounted to two hundred and forty dollars in total. If we assume that the seventy-seven households affected by multiple cases of unseasonable illness would have received thirty dollars per year compensation—like Josiah White—then the proprietors would have been liable for $2310.00 in damages for every year that they maintained their dam. Thus, eight years of damages caused to fisheries, farms and public health by their works would amount to approximately $29,000.00. Injuries suffered as broadly as those caused by this first dam would have been impossible to remedy through damages alone, and the Proprietors wisely ensured that removing the dam would also help to remove these liabilities.[58] Responsibility for the sales of this round of lottery tickets fell on the town of Northampton, so the townspeople themselves either ended up buying the majority of the tickets or paying greater expenses out of their own share of the damages to sell them elsewhere in the vicinity. In either case, ordinary citizens—even if they were fully aware that they were voluntarily paying in the Proprietors' stead—bore the expense of redesigning the dam, deepening the canal, and settling damage claims.[59]

The problems solved by removing the dam reflected the restoration of the landscape's seasonal integrity. To do this, the proprietors deepened the canal and built a series of locks, transforming the geology of the riverbanks in South Hadley, while removing the dam whose backwater had transformed the landscape north of the town. Viewing the restructuring of the canal as negotiations over whether the proprietors would reshape seasonality or geology emphasizes the key element of their agreement going forward. Neither side had made any comments on the legality of building a dam, and indeed, the town of Northampton had specifically instructed their state representative to negotiate a settlement that remained agnostic about the legality of a dam at South Hadley Falls. Consequently, these negotiations between modifying seasonality and geology avoided any mention of the historical precedents that this agreement set. This would prove consequential as a string of dams were built and washed out at South Hadley Falls.

58 "Number of Sick in Northampton 4 Years Past" 1801 S. Doc. 2748 nos. 21 and 19 MSA; White, "Claim for Damages by Flowing"; Old Rainbow Fishery Petition; Hockanum Fishery Petition; Simon Clapp et al., and Jonathan Strong et al. Petition for Damages and Order, Hampshire County Court Records, v. 19, p. 195 Umass.

59 Minutes of Proceedings, 16 January 1799 Document A C-2,f[b] L&C described the agreement between William Hooker—the Proprietors' lawyer—and John Taylor—representing the town.

Cooley's Canal, 1806-1822

Ariel Cooley made the South Hadley Falls Canal a viable improvement to navigation and the South Hadley Falls Canal made Cooley a wealthy man and a respected engineer. He took over all of the responsibilities that had been distributed between Christopher Colles, Elisha Mack, Jonathan Bennett, and Benjamin Prescott, and oversaw their completion on his own. Little is known about Cooley's life before he began working on the canal. A native of the outlying village in Springfield, Massachusetts that would become Chicopee, Massachusetts, Cooley had been a contractor helping with the construction of the dam and inclined plane at South Hadley in 1793.[60] His initiative in rebuilding the canal established a dual legacy. First, he built up his fortune as a local magnate, operating businesses including the local tavern and a sawmill, both of which benefitted from his role in managing traffic through the dam. At the same time, his success in deepening the canal established his reputation as a hydraulic engineer and resulted in a series of other contracts to complete engineering projects along the James River in Virginia and the Schuylkill River in Philadelphia. He would die in 1822 while working on the waterworks at Philadelphia, and his contract to manage the South Hadley Canal passed to his son in law Enoch Chapin, who would effectively settle the legal conflicts surrounding the canal and dam.[61]

Cooley's contract began during the summer of 1803 when he began work removing the dam, deepening the canal and building a set of locks to replace the inclined plane. This eliminated the need for a dam, but it also changed the array of challenges associated with navigating the river. Where the inclined plane had consumed large quantities of lumber and the

60 Minutes of Proceedings, 31 July 1792, I-2,c, L&C, Noted a bill from Ariel Cooley; Minutes of Proceedings 16 January 1799, C-2,d, L&C (Establishing a Wage and fee for Ariel Cooley's work on the Willimansett Falls)

61 Cooley Estate papers, Chapin Collection, Group 8 Box 3 Folder 9, SHM.

decomposition of these boards had necessitated constant attention to reconstruction and maintenance, a deeper canal cut into the bedrock required ongoing dredging as soil running downstream was deposited in the slow water pooled in the locks of the canal.[62] In addition to its role in alleviating the increased flooding and pooling of water upstream, the rebuilding of the canal transformed the flow of water through the locks themselves. This, in turn, contributed to the changing array of laborers who worked alongside the canal, assisting in the process of dredging its channel and piloting boats along its course. Between 1803 and 1828, company records describe adaptations to the growing size of rafts, requiring increasing labor inputs and the transformation of the waterscape to accommodate greater volumes of shipping. The growth of shipping, and the ongoing changes in the profile of sandbars below the canal increased the need for pilots to guide boats through the water and decreased the flexibility available to canal operators when dealing with the deposition of sediment in the canal itself. Cooley's accounts indicate that he regularly employed laborers to dredge the canal and keep it running.[63]

Cooley's personalized management of the canal reflected a broader sense of the personalization of navigational skill in the nineteenth-century Connecticut River Valley. This

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62 Bills and Receipts, various dates 1827-1828 L&C H-1,c; Ariel Cooley, Note to Peter Pease, July 1820; Receipt Paying Henry Robinson for work completed between 9 August and 11 December 1822; Enoch Chapin, "Settlement of Accounts with Ebenezer Ingraham" 1823-4 Chapin Collection, Group 8, Box 3, Folder 8, Springfield History Museum; "Bill for Cleaning out Canal, 1-4 September 1823, enumerating 35 person/days of labor in dredging out the canal, Group 8 Box 3, folder 10.

63 Cooley's Proposal for Amending the Works, n.d. (prob. 1801), M-1,unlabeled, L&C; A bill for cleaning out the canal described the hiring of twelve laborers to provide 35 worker days of labor between 1-4 September 1823, A Separate bill from Peter Chapin noted 43 days spent repairing locks in 1823; Chapin Cooley papers Group 8 Box 3 Folder 10, Connecticut Valley historical Museum, Springfield, Mass; H-1,c L&C consists of a packet documenting roughly biweekly work clearing out trash from the canal bed in 1827 and 1828 including bills from Justin Day, Henry Robinson, Levon Smith, and Caleb Hill.

suited landowners upstream, as all of their suits named specific canal operators—such as Ariel Cooley and Enoch Chapin—as defendants. At the same time, it suited the boatmen navigating the river, who themselves depended on their own expertise and wits while negotiating everything from shoals to tolls. An individual's public reputation meant more to people working with the river than the reputation of a corporation. Navigating rapids depended on the abilities of boatmen to read the river, and where their own readings fell short they turned to the expertise of pilots who specialized in navigating a specific reach. Where a canal operator found that their reach had been rendered non-navigable by low water they were expected to find the lighter boats that captains could use to offload their cargo and negotiate the shallows. Where the current read too fast for upstream travel, captains recruited crews of men and teams of oxen from local communities to help move boats upstream. And finally, when boatmen reached a lock, they not infrequently haggled with the tender, trying to convince him that a discount was in order. This reflected the financial stake that boatmen took in their shipments, taking a flat rate for their cargo and then paying tolls, the cost of labor, and any other incidental expenses out of their own pockets.[64]

Cooley developed his public persona while working on the canal by entangling his finances with those of the canal company. This marked one of the ironies of the proprietors operation, that their corporation profited most when it could connect its revenues with the reputation of a private manager, and particularly a private manager who took every opportunity

64 Edward Pressey, *History of Montague: A Typical Puritan Town* (Montague, Mass.: New Clairvaux Press, 1910); Miller v. Ward 3 Conn. (1819) 494; C.W. Bliss, “The Rafting Gangs” in W.D. Wetherell, ed. *This American River: Five Centuries of Writing on the Connecticut River* (Hanover, NH: University press of New England, 2002) p. 102-108; Bill Gove, *Log Drives on the Connecticut River* (Littleton, NH: Bondcliff Books, 2003); T. H. Dewey, “River Reminisces” *Springfield Republican* 10 May 1872.

to turn cash debts into exchanges grounded in credit and barter. Laborer Ebenezer Ingraham's work on the canal was compensated through credit at the store of Chapin and Cooley, a partnership that ran the store and tavern at South Hadley Falls. They compensated laborers' contributions to canal maintenance with store credit while collecting tolls in cash and using these revenues to purchase goods for their store and tavern. In this sense, Chapin and Cooley ran South Hadley as something of a company town. Similarly, Horace Allen earned seventy-five cents in credit from Chapin and Cooley's store for getting Levi Palmer's boat unstuck from the falls.[65] The payments issued by Chapin and Cooley do not just reveal the interconnections between their personal business interests and the operation of the canal. They also reveal varieties of paid work and maintenance on the canal that appear to reflect a spontaneous and relatively flexible system of contracting in a neighborhood where allowing water to flow out of place for even brief periods of time could cause significant maintenance problems. Twice during March 1824 Ingraham received payments for stopping water flowing between his house and the canal that was causing gullies to form in the canal banks.[66] This entanglement between Cooley's finances and those of the canal itself led him to guarantee payments to shippers even if there was no guarantee of support in repayment from the Proprietors at large. This is because his personal reputation depended on the reliability of the canal as a place of shipping. One of the boatmen running the Willimansett Rapids on 22 July 1810 hit the rocks and lost 2400 pounds of oats.[67] In guaranteeing this shipment, Cooley provided fewer details and less evidence of having

65 Cooley Estate Papers, Gr. 8, Box 3 Folder 10

66 Ebenezer Ingraham, Bill, C-CP Box 3 Folder 8

67 Receipt for 11 Hhd. of oats sunk at Willimansett, 21 July 1810, E-1,n, L&C; Conversion grounded in weight-volume conversion from William J. Murphy, "Table for Weights and Measurement of Crops," University of Missouri Extension Service, extension.missouri.edu.

investigated the moral probity of the claimant. This likely resulted from his presence onsite at the canal and his engagement with the work of shipping. These practices helped to foster goodwill among shippers and kept complaints about damages out of the courts.

The maintenance of the canal might have continued apace through the succeeding decades if the growth of log rafts—carrying downstream the produce of forest clearance in New England's sheep boom and the settlement of the upper valley—had not required the expansion of the canal.[68] Concerns about the insufficiency of water to accommodate the volume of shipping arose as early as 1812, drawing the directors into discussions with Cooley about redesigning the works.[69] Boat captains complained of the increasing size and top heaviness of the log rafts that competed with barges for passage during periods of low water. They placed stress on the water supplies that formerly carried shipping downstream.[70] These rafts posed a special problem because they consisted of more than just a single boat. Lumbermen lashed logs together into rafts rather than running them downstream loose. The sheer volume of logs contained in a raft

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68 David R. Foster, "Land-Use History (1730-1990) and Vegetation Dynamics in Central New England, USA," *Journal of Ecology* 80, no. 4 (December 1, 1992): 753–71; David R. Foster et al., "Wildlife Dynamics in the Changing New England Landscape," *Journal of Biogeography* 29, no. 10–11 (2002): 1337–1357, doi:10.1046/j.1365-2699.2002.00759.x.
Howard S. Russell, *A Long, Deep Furrow: Three Centuries of Farming in New England* (Hanover, N.H: University Press of New England, 1976); Harold Fisher Wilson, *The Hill Country of Northern New England; Its Social and Economic History, 1790-1930*, Columbia University Studies in the History of American Agriculture, no. 3 (New York: Columbia University Press, 1936); Grant Powers, *Historical Sketches of the Discovery, Settlement, and Progress of Events in the Coos Country and Vicinity: Principally Included between the Years 1754 and 1785* (Haverhill, NH: J. F. C. Hayes, 1841);

69 Minutes of Proceedings, 9 January 1812, L&C, M-2,t

70 Philips Ripley and Edward Gustine, "An Account Against the Proprietors of the South Hadley Canal for Damage Sustained in Our Passage July Last" 23 October 1826, "Bill to John Nash & Co. for extra Shipping Charges and Help at the Head of the Canal" 21 May 1817, Box 3 Folder 8, C-CP, CVHM.

presented its own challenges. Log rafts were divided in boxes, or divisions, which could measure twelve feet by sixty feet. Four to six of these boxes were and then lashed one to another into a raft.[71] Boxing logs into rafts tended to keep lumber together and made it possible to concentrate laborers in the carrying of logs through canals, particularly as the dams that fed them created eddies and whirlpools at their feet. Boxing timber also reduced the amount of lumber vulnerable to theft or loss.[72] This practice made the work of navigating log rafts into one where pilots and captains took on special responsibilities for navigating between shoals, eddies, and narrows along the river's changing channel.[73]

Responding to the increasing number of log rafts, Cooley rebuilt the dam in 1814. He constructed a six-foot tall dam running directly across the river from the lower entrance to the canal. This was intended to improve navigation without reigniting the conflict with upstream landowners.[74] His dam required replacement after the freshet of 1815, but after the completion of this work, he enjoyed three years of relative peace in managing the dam before the town of Northampton convinced the Commonwealth to prosecute the dam as a nuisance. In the town's opinion, the central question remained whether or not the Proprietors, or their agents, had any right to build a dam.[75] The town described the river as "a common highway and passage for the water and freshets to run through and discharge themselves into the ocean and that any

71 C.W. Bliss "The Rafting Gangs"; This did not differ dramatically from Morse, *American Geography*, 5th ed.; *Churchill v. Watson* 3 Days Conn. Rep. (1811); *Miller v. Ward* 3 Conn (1819) 494-502

72 Gove, *Log Drives.*

73 Dewey "River Reminisces."

74 "Abstract of a memorial to the legislature by Selectmen Against the South Hadley Canal" 20 April 1825 F-2,h, L&C suggests that the dam was six feet tall.

75 Commonwealth v. Ariel Cooley 3 Hampshire Supreme Judicial Court (1819), 190.

obstructions in said river…are causing the overflowing of the adjacent meadows."[76] The river completed a public service simply by flowing to the sea and this service meant that any dam along the river would be illegal. This was an interesting suit in and of itself, because of its approach to the question of what it meant for a river to be a public highway. Did it mean that all of the flows up and downstream, whether they consisted of floodwaters rushing to the sound, fish returning upstream to spawn, or boats running cargo to the ports at Hartford and points south, qualified as part of the river's nature as a public highway.

The petitioners grounded their arguments in a public right to the river, a legal approach that appears to have anticipated the later developments that would occur under the public trust doctrine.[77] Although the canal company's public mission, and a key element of their operations, served navigation, the complainants insisted that their operations served a private interest first and actually obstructed navigation in their operations. Notably, their vision for a free flowing river did not focus on the idea of boatmen trying to run the rapids at South Hadley, but instead, they explained the ancillary benefits of the free flow of water to the river as a whole. Treating the Connecticut as public highway provided a means of arguing that the free flow of the river would reduce the severity of freshets and improve fish migration. Such arguments stretched the boundaries of the public interest from navigation as an act of shipping to navigation as the free flow of both water and commodities.

76 ibid.

77 Robin Craig, "A Comparative Guide to Eastern Public Trust Doctrines" *Pennsylvania State University Environmental Law Review* 16 no. 1 (2007): 1-114.

They found this argument in the legislation granting the lottery for rebuilding the canal "Without the Aid of a Dam."[78] In the minds of the petitioners, the decision to provide a publicly supported funding mechanism for designing the canal without a dam established that the canal could, and needed to, operate without a dam if it was going to operate within the strictures of its charter. This debate continued an ongoing conflict among residents. The jury found Cooley not guilty. Nevertheless, the suit is credited with encouraging him to settle one key issue by engineering a fishway negotiating the dam.[79] This fishway consisted of a roughly twenty-foot-long gap in the dam on the west shore of the river. Here a wing dam served to create an eddy in the water flowing over the dam, providing a space for the shad and other anadromous fish to congregate and attempt to pass up the dam's face (see map). The turn to lower dams and fishways necessitated a range of locks, lighters, pilots, dredges, and winch mechanisms to negotiate the navigational challenges running up and down stream. In developing these techniques for dealing with navigation, the neighborhood around the South Hadley Canal grew into the Canal Village. This community of laborers, pilots, millers, storekeepers, and tavern keepers owed their livelihoods to the network of compromises resulting from an adversarial process of development. The community of the canal village would not have grown to its eventual size without the Proprietors having increased the complications associated with shipping. Perhaps, this early adversity also made the canal more adaptable when faced with the increasing size of log rafts running downstream in the 1810s and 1820s.

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78 "An Act Granting a Lottery for the Purpose of Rendering the Locks and Canals at South Hadley passable for Boats and Rafts of Timber, Without the Aid of a Dam Across Connecticut River" Ch. 48 1801, passed 25 February 1802.

79 Josiah Holland, *History of Western Massachusetts* (Springfield, Mass.: Samuel Bowles, 1855) 308

Even while settling the question of whether the eleven-foot-tall dam at the head of the oblique dam was illegal, the Proprietors disagreed with the argument that building any dam would be illegal. In their petition for the 1801 lottery to fund the first dam's removal they maintained its legality "because in and by the act of incorporation the Proprietors were requested to erect, keep up, and forever maintain such dams, canal and locks as that rafts and floats of timber might pass down and boats and other craft might securely pass up the river."[80] The key to this debate lay in the question what exactly proved necessary for boats and rafts to pass up and down the river. In their 1803 suit against the first dam, the citizens of Northampton pushed an interpretation of the charter that did not include a dam. The proprietors, however, had carefully avoided any statements about the legality of dam building in general when they settled the dispute over the status of the eleven foot dam during the opening years of the 1800s. Going forward from this suit, the proprietors argued that they should have the right to facilitate rafts and barges as large as any boatmen could float downstream.

Cooley's success in managing the canal produced profits for the proprietors, but the magnitude of his personality in the canal's success meant that it would be difficult to separate his finances from those of the canal. His death in 1822 prompted an audit of his practices in managing the canal, and one of the central concerns to emerge was that he had abused his managerial position by buying timber that would have been navigated through the locks and paid tolls so as to feed his lumber mill operating below the locks. The audit found that 58,182 feet of lumber had been bought from boatmen whose rafts had come unfixed between Northampton and the dam, and another 88,815 feet of lumber had been drawn through the canal with toll paid.

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80 "Petition of Proprietors Applying for Assistance in Removing the Dam" in "Granting a Lottery" Acts 1801 Ch. 48, Doc. 2.

About forty percent of the lumber drawn down to Cooley's Mill had not been subject to tolls and likely had been purchased in negotiations rendered far more favorable to Cooley because he also negotiated tolls and the fines associated with lumber washed into the canal.[81]

While Cooley collected and appropriated timber, the treatment of wayward logs as a windfall benefitting the landowner who found them was common throughout the valley. It was not strictly the prerogative of the canal company. Bridge companies as far north as Northfield on the Vermont Border and as far south as Hatfield complained of log runs threatening their piers, and in high water threatening the bridge flooring itself.[82] Residents of Deerfield regularly ventured into the meadows after floods to collect wayward logs for processing at the local mill. Cooley's neighbors downstream in West Springfield remembered fondly their days scavenging lumber and likely used it to as arbitrary an end as Cooley did. Recollections collected by a reporter from the Springfield *Republican* writing about the history of flooding included one tale of pig sheds built of well-seasoned black walnut. Until long after the closure of the canal at South Hadley, the prospect of scavenging logs would be treated as a natural right upon the river just like fishing or boating.[83]

81 Account of Timber Bot [sic] for A. Cooley 1822 and Delivered at his Saw Mill, L&C, E-1,b

82 "Petition of J. Barrett and others" 1815, Massachusetts Senate Unpassed Legislation, 5116 MSA, petitioned against the shipping of loose logs down from New Hampshire. One of the central problems faced in this petition was a privilege granted to folks in Walpole, NH who did not want to raft their lumber. Hatfield Historical Society has the skinny on the old bridge.

83 David Hoyt, Diary, 16 May 1806 AAS; Loose logs continued to be a problem throughout the nineteenth century Julius Robbins, Diary, Historic Deerfield, 6 August 1856; Robert Ely quoted in "Floods as they Have Been" *Springfield Republican* 28 April 1895 p. 8 described the tradition of scavenging floodwood in the neighborhood of Double Ditch, West Springfield. That being said, Pressley et al. *Montague* noted that the town records contained an annual section listing the marks of logs found on people's property.

Chapin's Canal, 1822-1828

In many ways, Enoch Chapin managed the canal on the same principles that Cooley had pursued. When two boatmen from Winchester, New Hampshire rafted through the locks in July 1826, they encountered delays brought on by low water. In a complaint against the manager of the canal, these two men, Ripley and Gustine, did not focus solely on the availability of water. Instead, they insisted that "had you [Chapin] been there when we arrived we should not have been detained as you would not have suffered these heavy timber boxes to go forward ahead of us as you would have known at once that they could not have passed and had we gone in first we would have got out without difficulty as while we were detained by them the water fell."[84] The growing volume of lumber carried in timber rafts and their increasingly top heavy design made it increasingly difficult to store adequate water in the canal to accommodate shipping. In this context, the compromises that the Proprietors had formerly made in dealing with upstream towns began to seem untenable in light of the need for a deeper canal fed by a larger reservoir.

Chapin operated the canal under Cooley's contract on behalf of his heirs between 1822 and 1828. At the same time, Chapin worked with mill owners who worked along the canal bank, bringing them into a common indenture to share water taken in by a wing dam at the head of the falls. This marked the beginning of a transition away from operating mills at the canal as an adjunct to the collection and management of cargo running downstream—a practice that Cooley had honed with his lumber mill. Instead, Chapin worked with a local mill owner named Josiah Bardwell to organize these water rights and set out the remaining water available in anticipation of selling the water to manufacturers working on concerns independent of the canal.[85] This desire

84 Philips Ripley and Edward Gustine to Enoch Chapin, 23 October 1826, C-CP Box 3 Folder 8.

85 *Josiah Bardwell v. David Ames et al.* 39 Mass (1839) 330 describes the process.

to separate the rights to water for power generation on properties below the canal from the operations of the canal itself signaled the broader effort that Chapin would make in disentangling his finances and personality from the operations of the canal. He wanted to make his own career independent of South Hadley Falls, but in order to do this he needed to establish the independence of the Falls from their superintendent and he needed the certainties that would come with legal approval for the canal's dam.

As he contemplated the enlargement of the dam at South Hadley—envisioning a structure six feet tall that could feed a deeper canal, the town of Northampton petitioned the legislature against his proposal. They claimed that the construction of a higher dam would amount to a violation of previous agreements made in good faith to remove the high dam after the establishment of a lottery to subsidize the reconstruction of the canal. At the same time, the town complained that the canal enjoyed a monopoly over shipping, and that this meant that boatmen would need to subsidize the construction of this dam without being able to access any alternative route around it. Finally, they complained that the dam would eliminate fisheries and cause renewed outbreaks of disease. In this complaint, the majority of their criticism focused on the ongoing problems that had accompanied the construction of the first dam, and the agreements that Cooley had made after the suit challenging the dam in 1819. Each of these complaints functionally reserved the rights of the town to prevent and insist on the abatement—or removal—of the dam should it prove a nuisance. Thus, there is little record of their ability to muster evidence that the 1825 dam actually caused ill health, obstructed navigation, or even reflected a play on Chapin's part to increase the costs besetting shippers, but nonetheless they pushed this suit forward. It is likely that this reflected a proactive approach to a dam that the townspeople of Northampton anticipated would actually constitute a nuisance.[86]

The proprietors invested heavily in arguments against the claims of nuisance in *Commonwealth v. Chapin.* Where the proprietors had rolled over for the courts in 1803, admitting many of the elements of nuisance, they worked to establish a strong argument for the dam in 1825. To this end, they carried out extensive investigations of how the dam affected drainage within the Northampton meadows, sought to document patterns of disease, and the affects of similar dams such as the Enfield Falls Canal Dam then under construction in Windsor Locks, Connecticut. This broad investigation brought together a mass of evidence that helped to rebut claims that the dam had threatened the health of communities living in its vicinity.[87] This signaled their resolution to overcome the historical memory of dam building as a process inherently harmful to upstream communities.

The 1827 case of *Commonwealth v. Chapin* would cover much of the same ground as the 1819 case, but it tackled the larger question of whether or not the proprietors had a right to build and operate a dam. Paradoxically, this meant debating whether or not the Connecticut River at South Hadley Falls was a navigable stream. The District Attorney complained that "by the dam the passage of boats, rafts, &c., up and down the river had been impeded, and the passage of salmon, shad, and alewives, which from time immemorial had passed up the river to cast their spawn, had been obstructed, and the adjacent meadows had been covered with stagnant water."[88] What was interesting about this assertion was not the damage to the meadows or fisheries, both

86 "Report of the Comm. to the Town of Northampton" 1 March 1825, F-2,g L&C.

87 "Assessment of Argument by the Town of Northampton" F-2,k L&C.

88 *Commonwealth v. Chapin* 22 Mass (1827) at 199.

of which constituted significant complaints throughout the canal's existence, but the alleged damage to the passage of boats. This claim about the boats clearly had little to do with the actual desires of the plaintiffs, who could only have invited shipwreck by sailing a raft down South Hadley Falls. The legal issue at stake was an inconsistency in the application of water laws across states, where Pennsylvania had ruled that the public right to a fishery could be claimed over and above the ownership of riparian land. Interestingly, the case deciding this issue, *Carson v. Blazer*, did not concern a broad public claim to fishing rights, but rather the rights of a particular individual who had improved a particular fishing hole.[89] By contrast, the state of Connecticut had decided in *Adams v. Pease* that the rights to a fishery adhered to the local landowner rather than the public at large.[90] Thus, the significance of the reference to *Carson v Blazer* lay in its establishment of both a public right to a fishery in the river at large and the vesting of private rights to fishermen who improve local fisheries. This would create a means of maintaining the private rights to fishery management that existed in places like Northampton's Rainbow and Manhan fisheries while simultaneously continuing the argument that the river was necessarily a public stream because of the commonality of fishing rights. The question at stake was whether the fishery amounted to a public good governed by common law, or a private good governed by statute. While under common law, the courts would be charged with "abating a dam which is found to be deficient," legal jargon describing dam removal, "the statute provides a pecuniary mulet, and gives power to certain municipal officers to supervise public interests."[91] The mulet, in this case being the power to establish damages and remunerate claims on fisheries

89 *Carson v. Blazer* 2 Binney (PA, 1810) 475.

90 *Adams v. Pease* 2 Conn. (1818) 481.

91 *Commonwealth v. Chapin* at 204

with their cash value rather than the fisheries that they formerly enjoyed. Instead of eating pickled shad, all the carping of upstream fishermen netted them only a pecuniary mulet. Perhaps more importantly, this left Enoch Chapin with a clear decision from the state supreme court indicating that the dam at South Hadley did not constitute a nuisance.

Chapin's decision in 1828 to petition the legislature for the right to dissolve the contract between Cooley's heirs—many of whom were minor children—and the Proprietors appears to have been timed to occur after the settlement of this suit.[92] which established that the canal company had a right to maintain a dam and that any complaints against it as an obstacle to fisheries would need to be settled at the municipal level through cash damages rather than in a judicial forum where abatement remained an option. From here, the dam would fall to the management of Josiah Bardwell, a mill owner living along the canal bank who managed the waterway with an eye toward expanding the industrial production going on at the falls. His efforts will come into focus in chapter five, which concerns the growth and transformation of manufacturing along South Hadley Falls.

Conclusion

The business of canalling was a business of compromise. The proprietors compromised with their own employees, by passing responsibilities for its oversight to strong willed and enterprising superintendents such as Ariel Cooley. The superintendent compromised with shippers in facilitating the expeditious transfer of their cargo while bargaining on rates and purchasing commodities such as lumber for his adjacent mills. The superintendent also

92 Commonwealth v. Chapin, 22 Mass (1827) 199; "Resolve on the Petition of Josiah Bardwell and Others" Massachusetts Acts and Resolves, 7 June 1828, Ch. 4 p. 38.

compromised with upstream communities, whose long memories of historical water use set boundaries around the future of water use. In making these compromises, the canal operators generated dividends, encouraged trade through the canal, and sought to minimize their impact on local hydrology. They repurposed a stretch of the river as a place that facilitated transportation where it was formerly unnavigable, creating new forms of expertise among pilots who facilitated shipping through the canal and adjacent shoals. At the same time, they struggled to accommodate the growing size of ships running through the canal without encroaching on the established rights of upstream landowners. The controversies and compromises that defined the operations of the South Hadley Canal reflected the broader challenges confronting efforts at transforming a settled landscape into one more suited to commerce. The proprietors did not have the option of running roughshod over the rights of upstream landowners and instead, they occupied the river in common with their neighbors.

In learning to make these compromises and working to facilitate the movement of goods past the South Hadley Falls, the proprietors fostered a working community whose efforts adapted the abstract idea of expanding commerce along the river to work within the limitations of water resources along the river. Similarly, the communities living upstream of the dam learned how to articulate their vision of region's hydrology in terms of the modifications and disruptions that it had experienced at the hands of the Proprietors of Locks and Canals. Like the workers in the canal village whose efforts made the flow of goods through the South Hadley Falls a smoother process, upstream landowners set boundaries on the canal system through their protests and lawsuits. Indeed, despite their vociferous calls for the elimination of the dam, the protests against the canal provided a means of integrating the South Hadley Canal into the local landscape by clarifying the rights held by the proprietors and those held by their neighbors.

The history of the South Hadley Canal enriches the overall story of the Connecticut River Valley, because canal building came to fit into a landscape already inhabited and a river system where existing water uses created strong pressure against repurposing the river. The proprietors acquired their charter by presenting themselves as public servants, but the communities living upstream from the dam insisted that this fealty to the abstract public good could not come at the cost of existing land and water uses in an interconnected stream. In addition to their service to society at large, upstream landowners insisted that the proprietors situate themselves as common users of the Connecticut River's flow. The lawsuits that arose around the management of the canal articulated a sense of what actually was common about that flow. They explained how seasonal patterns of drainage and the maintenance of fisheries should shape the design of the dam and the canal running down the falls. At the same time, this common right did not prove powerful enough, despite its seniority, to fulfill the wishes of the landowners who wanted the river to remain undammed.

To call the business of canalling a business of compromise may smell of wishy-washiness. Did the South Hadley Falls Canal adapt to upstream water users or did the upstream water users adapt to the canal? In order to answer these questions, we need to stop and think about what it would have meant under the circumstances for either the proprietors or their upstream neighbors to prevail decisively in their suits. Knowing what we do about the outcomes of these suits, what would decisive victories or losses have looked like? It is worth teasing out both of these perspectives because they tell contrasting stories about how the canal reshaped the communities through which it flowed.

The canal adapted to upstream water users insofar as the height of the dam reflected the maximum attainable backwater consistent with the continued effective drainage of the meadows. At the same time, the maintenance of fishways that kept fisheries open above the South Hadley Falls—even if these fisheries were a mere shadow of their former selves—indicated the continued power of upstream water rights even on a dammed river. Finally, the continued accountability of the canal to demands that it respect the health of upstream communities and the continued attention to the possibility of its responsibility for disease outbreaks forced the proprietors to work with their neighbors in managing the flow of water. While the upstream communities might have cherished a dream that the river would flow freely to the sea, and their legal complaints included language about the importance of this dream, this demand remained decidedly secondary because it was not integrated with any language describing a specific harm that arose from the existence of the dam. Nevertheless, had the upstream landowners prevailed, they would have been able to remove the dam and this would have improved drainage on the lands cultivated along the river's floodplain while reducing the scale of shipping that could run through the canal.

When upstream water users adapted to the canal, they accepted its appropriation of a portion of the common flow of water running downstream. They made their peace with the limits of their property rights in water and recognized that this would add to the stresses on fisheries and drainage throughout the river system. At the same time, the found themselves bound to adapt to the compromises making the canal simultaneously a private enterprise and a public service.

This acceptance had several elements. First, they accepted the public accounts of the canals operations and condition, where they might have called its bluff and driven it from business during the earliest nuisance suit. By accepting the narrative of the proprietors' penury and the necessity of a subsidy for the reconstruction of its works, they adapted to the canal's presence on the landscape. Further, they also lived on after losing the subsequent law suits seeking the dam's removal. The landowners upstream did not adapt fully to the new canal. Had the proprietors won that earliest lawsuit, then they would have possessed a right to flood upstream meadows to an extreme that would have essentially eliminated the floodplain farms of Northampton, Easthampton, and Hadley.

Instead of handing a wholesale victory to one party or the other, the ultimate consequences of these compromises resulted in the modification of the river so that it could facilitate new forms of work. The proprietors repurposed the flow of water that had formerly served to facilitate farming and made it a tool of navigation. It replaced the brawn, packing skill, and muscle power that had formerly carried goods around the falls with new forms of strength and knowledge grounded in the reading and navigation of the waterway itself. The work formerly done by laborers along the riverbanks became work done by the river under the watchful eyes of boatmen who worked to steer clear of shoals. The skills in navigation and shipping gained through years of guiding boats through the canal made it possible to maximize the size of cargo while minimizing the footprint of the canal. In this sense, the work of maintenance and pilotage that defined the day-to-day operations of the canal helped to shoehorn this new water use in alongside the communities living upstream.

This approach, however, does leave the question of the underbelly of the business of canalling unaddressed. What did it mean for the proprietors to operate in private in ways so clearly at odds with their public persona? A range of activities including their insistence on public harm as a means of acquiring subsidies and their conviction that the operation of the canal depended on subsuming the corporation's work under Ariel Cooley's management suggest that the proprietors understood their work as a public service that depended on the alignment of private interests. While it may have been possible to imagine a navigational improvement as an abstract contribution to the public good, the realities of water management in the Early Republic depended on the personalities of shippers and canal managers to keep goods moving. It was in this friction between the public good served by the development of a common resource and the private incentives necessary to foster this development that provided the framework for adapting the canal to the demands of upstream landowners. In order to have debates over the canal's role in shaping the public interest, the proprietors needed to make their engagement with the landscape clear.

In order to appropriate part of the river while maintaining its status as a common resource, the proprietors needed to engage in the business of canalling as both a public enterprise and the sum of innumerable private interests. This intertwining, and the compromises that it inevitably entailed, meant that the proprietors could simultaneously appear to be public servants and avaricious appropriators of a common resource. They could simultaneously engage the public while hiding the true material and operational state of their works. Perhaps most importantly, they could engage with the private forms of knowledge about the river held by individual boatmen and pilots while simultaneously insisting on their role as public servants facilitating significant volumes of trade through the valley. All of these claims made it possible to integrate the South Hadley Falls Canal into the broader network of water uses that coexisted within the valley.

The canal retooled the river, making it a conduit for trade on a hitherto unseen scale. At the same time, it also created a hydrologically interconnected reach upon the river by transforming its flow in historical time. The memories of this intervention on the landscape, enriched and emphasized by the proprietors decision to exacerbate and exploit the canal's damages to public health, played a key role in shaping future restrictions on the design and operation of the canal. Historical memories of water use, and conflicts over their exact terms and implications for the future of water management in the valley, would take on increasing importance as the Connecticut Valley underwent industrial transformation. This question of whether and to what degree one could appropriate an increasing volume of water would intensify. Factories came to depend on increasing amounts of water as they sought to increase production. Meanwhile, the passage of time created leaks and fissures in their canals and dams, limiting the total amount of water that they ponded. These tensions made the modification and improvement of water power dams a going concern analogous to the challenges faced by the proprietors. Could the owners of a dam modify their work in a way that prejudiced the water rights of downstream users? This question concerned both the growth of factories and also their maintenance, as a leaky dam could provide water for a downstream user. These questions about how to establish precedence in water rights and the role of maintenance and expected water uses in shaping possible water uses will provide the focus for the next chapter.

Chapter Four:
Ancient Rights for a Modern World:
water power, Landscape Change, and Public Memory in the Connecticut Valley 1821-1863

Water rights last in perpetuity, but demand for milling changes over time. These clashing timescales created an odd masquerade where factory owners on the leading edge of manufacturing dressed their factories in the clothes of ancient mills. These owners used water rights grounded in historical practices, namely mill rights for grist and saw mills serving community demand, when building factories for industrial production along the tributaries of the Connecticut River. Agreements granting this access to water provided a historical account of how water had been used and mill owners interpreted these statements to determine how it ought to be used going forward, but any modifications in water use created the possibility for legal conflict. Records of these legal conflicts provide a window into how industrial water users thought about the flows powering their mills. They illustrated some of the strategies that mill owners developed for measuring and distributing water in a context where the actual volume of water flowing over their wheels could not be measured directly. At the same time, they reveal a change in the logic of legal decisions about water power use in manufacturing. Between 1821 and 1863, judges began treating custom as just one more type of contract subject to the strictures applied to written evidence as agreements written for the purpose of establishing property rights. This codification of contract had the ancillary effect of codifying the improvised methods for measuring the flow of water and institutionalizing the small-scale approaches to water use that defined these early strategies for water-sharing.

In strict legal terms, an "ancient" right accrued to a mill owner who had flooded upstream land for twenty years without complaints, acquiring the right to continue their millpond in its current state.[1] In practice, ancient rights often described a network of customs, privileges, and obligations that communities attached to the grist, saw, and fulling mills. Customary obligations changed from generation to generation by turns accruing and eroding depending on the relationships current in the memories of local residents. These rights changed insensibly over decades of neighborhood life. Factory builders often purchased and repurposed ancient rights that had been proven because they established a precedent for water use that limited liability and helped to prevent the establishment of rival water users. At the same time, limitations in capital necessitated water-sharing, and factory owners often subdivided their own power rights, creating the potential for rival water users to intervene in the design and operation of a factory. In each of the four court cases that form the center of this chapter multiple factory owners shared the rights to a single millpond running over a common falls.

The four cases considered in this chapter exemplify the changing understanding of history at work in legal cases arising from conflicts between mill owners. The analysis of the first case, *Hatch v. Dwight* (1821), looks at a contractual dispute that occurred independent of historical claims to water rights, exploring how the court interpreted the passage of time independent of the strictures of customary water use. The second case, *Bliss v. Rice* (1835), asks how ancient rights survived alongside contractual readings of water rights. The third case, *Inhabitants of Hadley v. Hadley Manufacturing Company* (1855) asks what shifts in the court's

1*Greenleaf v. Francis* 35 Mass (1836) 117 documents the case history behind the principle that ancient rights accrued through twenty years of adverse use; Joseph K. Angell *A Treatise on the Law of Watercourses* 4th ed. (Cambridge, Mass.: H. O. Houghton, 1854) 287-290.

reading of water contracts led to the abandonment of custom in water use. The fourth case, *Pratt v. Lamson* (1863) asks what limitations existed in the use of contracts to limit the passage of time.[2] Legal arguments for water rights all depend on some form of historical argument, but why did particular forms of historical argumentation take precedence and how did this shape industrialization?

This chapter relies on legal cases for its primary sources, but it does not follow the general tenor of legal history.[3] It focuses on what legal decisions tell us about landscape change rather than studying the evolution of doctrine as an end in and of itself.[4] Most legal history works to identify doctrines working across time in discrete cases, so legal historians working with water law in the nineteenth-century Northeast generally focus on the transition from the occupancy doctrine to the reasonable use doctrine.[5] Under occupancy doctrine, mill owners established their rights to streamflow based upon their longstanding use of water without objections from neighbors. This provided a sense of fairness for established users, but it could obstruct the claims

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2 *Mercy Hatch v. Josiah Dwight et al.* 17 Mass (1821) 288; *Theodore Bliss v. Charles Rice* 34 Mass. (1835) 23; *Inhabitants of Hadley v. Hadley Manufacturing Co.* 70 Mass (1855) 140; *Josiah Pratt v. Nathaniel Lamson et al.*84 Mass. (1863).

3 Hendrik Hartog, *Public Property and Private Power: The Corporation of the City of New York in American Law, 1730-1870* (Chapel Hill: University of North Carolina Press, 1983); James Willard Hurst, *Law and the Conditions of Freedom: In the Nineteenth-Century United States* (Madison: University of Wisconsin Press, 1956); William J. Novak, *The People's Welfare: Law and Regulation in Nineteenth-Century America* (Chapel Hill: University of North Carolina Press, 1996).

4 Austin Sarat and Thomas R. Kearns eds., *History, Memory, and the Law* (Ann Arbor: University of Michigan Press, 1999) discusses this distinction in depth.

5 Morton J. Horwitz, *The Transformation of American Law, 1780-1860* (Cambridge, Mass: Harvard University Press, 1977); Jouni Paavola, "Water Quality as Property: Industrial Water Pollution and Common Law in the Nineteenth Century United States," *Environment and History* 8, no. 3 (2002): 295–318.

of new entrants into water power development. Under the reasonable use doctrine, adjacent riparian property owners shared equal and proportionate rights to water regardless of the uses active upstream and downstream. The transition from occupancy to the reasonable use doctrine, occurred during the 1830s and 1840s, and the cases of *Bliss v. Rice* (1835) and *Pratt v. Lamson* (1863) can be read to illustrate the nature of the contest between these two approaches to water use.[6] Rather than treating these doctrines as ends in and of themselves, this chapter uses legal cases as evidence of how people situated their work with water historically and what possibilities and constraints these historical perspectives opened up for industrial development. Because of this approach, my reading of cases as presented in published decisions treats them as historical works, asking how judges, plaintiffs, and defendants situated their water use historically, what types of historical evidence they privileged, and how their ideas about history reflected changing ideas about the possibility of development.

Ancient rights and contracts both encouraged careful descriptions of water power infrastructure and simultaneously discouraged the commodification of water as an abstraction disconnected from particular mills. They encouraged innovation within the bounds of existing mill sites, but they made it difficult to develop water resources across mill sites. This limited the scale of development, narrowing the scope and application of water storage strategies that could even out flows across the year. Storage reservoirs only came to the valley relatively late, with the most famous example being Mill River Reservoir which was completed only in 1864.[7] Without

6 Carol M. Rose, "Energy and Efficiency in the Realignment of Common-Law Water Rights," *The Journal of Legal Studies* 19, no. 2 (June 1, 1990): 261–96.

7 Elizabeth M. Sharpe, *In the Shadow of the Dam: The Aftermath of the Mill River Flood of 1874* (New York: Free Press, 2004); Robert B. Gordon, "Hydrological Science and the Development of water power for Manufacturing," *Technology and Culture* 26, no. 2 (1985): 204–35.

interconnected reservoirs that could release water during periods of scarcity, the mill operators on the Connecticut and its tributaries adjusted their production schedules in rhythm with seasonal cycles. Moreover, the creation of storage networks required clear title to relatively large expanses of water. Mills already exercising an existing claim to water presented an obstacle to storage systems. Thus, the process of industrialization in the Connecticut Valley did not follow the course charted in the Merrimack, where heavily capitalized manufacturers from Boston came to dominate the watershed and bend its varying flows to their desire for a steady supply of water.[8]

Instead of coordinated storage, the water-sharing agreements in place across the valley concerned the design and placement of flumes and millraces on shared millponds and the prevention of backwater issues in dams at neighboring fall lines. The nature of these agreements ultimately limited the flexibility of factories adapting to new forms of production. Rather than making an immediate intervention that regularized the tempo of water's flow, water sharing agreements accepted the existing patterns in that flow and sought to ensure clarity in the competing historical claims to water rights that existed within individual reaches of the river. The conflicts that arose in the renegotiation of ancient rights and water-sharing agreements proved an obstacle to the commodification of water because they prevented the forms of technological and managerial innovation that enabled the precise measurement of water's flow.[9]

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8 Theodore Steinberg, *Nature Incorporated: Industrialization and the Waters of New England* (Cambridge: Cambridge University Press, 1991)

9 Theodore Steinberg, *Nature Incorporated*; Francois Weil, “Usines en Ville: Histoire Sociale d’une Enterprise Textile Américaine, la Dwight Manufacturing Company, 1841-1930” (Ph. D. Dissertation: University of Lille, 1991); Jonathan Cumbler, *Reasonable Use: The People, the Environment, and the State in New England, 1790-1910* (Oxford: Oxford University Press, 2001)

Small dams built without a watershed-based understanding of flow encouraged the treatment of the water itself as an adjunct of the water management infrastructure rather than a quantifiable and marketable object that existed independent of the mechanics of a factory's operations. These cases demonstrate that during the first generation of industrialization, water existed as an extension of the land market rather than an abstract commodity. While the most famous examples of industrialization in New England—occurring in cities such as Lowell—manipulated water as a measurable commodity available for sale to multiple factories, and possibly amenable to market pricing, water-sharing agreements in the Connecticut River Valley could not attain this level of specificity. This resulted from the lack of storage capacity and the lack of a central monitor charged with measuring and disbursing set quantities of water. Factory owners could specify the details of the infrastructure drawing water from a millpond into a factory's wheel, but they could not quantify the amount of water being used. The velocity of water flowing through a wheel depended on the total volume of water flowing through the millpond—including so-called waste that flowed over the lip of the dam, whose weight contributed materially to the speed at which water flowed through flumes.[10] This meant that contracts to divide water did not necessarily correspond with a specific volume of water powering mill wheels or running machinery. Instead, they divided water with a variety of strategies including the position of the mill in the stream, the days upon which a particular miller had access to water, the claims that customers could make based upon their historical relationships with the mill, or the size and position of flumes drawing water into the factory. This difference, in tandem with the inseparability of a mill right from its surrounding landscape

10 Louis C. Hunter, *Water Power in the Age of the Steam Engine*, vol. 1, A History of Industrial Power in the United States, 1780-1930 (Charlottesville: University Press of Virginia, 1979).

combined to make sites of water power commodifiable while water remained only one element of that commodification. These cases are important because they provide examples of how communities attached different meanings to the flow of water in contexts where they could only think about its flow within the physical geographical context in which it occurred. In their minds, water had value as a product of its use in a particular context. This made the historical memories of how people had worked with water in a particular place important in a way that the amount of water that they consumed or the power that they derived from it was not.[11]

Two key differences distinguished the industrialization of the Connecticut River Valley from its neighbor to the east, the Merrimack, whose flow powered the textile mills of Lowell, which remain the standard bearer for the history of industrialization in New England. The first is the absence of watershed-scale water power management strategies. The second is the sale of mill sites rather than abstract quantities of water power. The mill owners in Lowell who drove the early years of the textile industry did not face conflicts over water-sharing in a context dominated by ancient mill rights because they subsumed their whole water power site under a single corporation. Factory towns such as Waltham and Lowell incorporated a single company to manage the water power site and the sale of shares in this company to individual mill owners, who incorporated individual factories and accessed portions of these water rights.[12] This made it

11 Descriptions of water's commodification appear in Jamie Linton, *What is Water: The History of an Abstraction* (Vancouver: University of British Columbia Press, 2010) p. 14-19; Donald Worster *Rivers of Empire: Water, Aridity, and the Growth of the American West*, (New York: Oxford University Press, 1984) p. 4-5; Steinberg, *Nature Incorporated*, 14-15.

12Theodore Steinberg, *Nature Incorporated*; for a history of the financial operations of the Boston Associates see Barbara M. Tucker, *Samuel Slater and the Origins of the American Textile Industry, 1790-1860* (Ithaca: Cornell University Press, 1984); and Robert F Dalzell, *Enterprising Elite: The Boston Associates and the World They Made* (Cambridge, Mass: Harvard University Press, 1987); To understand another perspective on why the Connecticut Valley differed from Lowell, see Francois Weil, "Capitalism and Industrialization in New England, 1815-1845," *The* possible for neighboring mills to buy and sell water and provided a private forum to adjudicate conflicts over water use between shareholders in the corporation. Such an approach reflected a perspective on water's value that differed from the experience of small mill owners in the Connecticut Valley, whose contracts were more easily litigable because they pitted two independent companies against one another. The Waltham-Lowell system consolidated a group of water rights holders into a unified corporation that only invoked public law when dealing with disputes arising away from the fall line, such as the conflicts between mills and farmers described in *Nature Incorporated.* Water-sharing contracts in the Connecticut River Valley brought disputes over water use under the jurisdiction of the state courts, making the idiosyncrasies of their contracts a subject of public dispute.

Differences over the precise meaning of a water right reflected the contested and often-contradictory narratives that people used to describe their rights to water power. Such conflicts played out in legal cases where rival mill owners argued over their right to use water. As we might imagine, these cases only arose when dam owners appropriated enough water to harm neighboring mills, whether these mills shared a millpond or they occupied two closely spaced dam sites. Under ordinary circumstances, the character of water-sharing agreements at fall lines remained invisible, likely subject to a private agreement, and they are generally unrecoverable because these agreements were not registered in the public record.[13] Communities could live with multiple contested understandings of how exactly mill rights worked so long as there was enough

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Journal of American History 84, no. 4 (March 1998): 1334–54; Idem, "Usines en Ville: Histoire Sociale d'une Enterprise Textile Américaine, la Dwight Manufacturing Company, 1841-1930" (Ph. D. Dissertation: University of Lille, 1991)

13 Carol Rose, *Property and Persuasion* (Boulder: Westview, 1994), 163-198.

water available to go around and it did not flood anybody's land.[14] In this sense, the four cases considered during this chapter mark the tip of the iceberg of industrial water-sharing agreements that effectively defined the scale and shape of industry in the Connecticut River Valley. Such agreements undergirded a vast but little-understood private infrastructure governing water use.

One reason for the dearth of attention to small water power users might be the contradictions in their deployment of the law. They readily used the mill acts of 1795 and later decisions under these acts to flood agricultural land with water for mill development. At the same time, they deployed their water-sharing agreements and customary water rights as an obstacle to further industrial development that would harm their mills. Thus, their approach to using the law as an instrument of economic development depended on two contradictory legal perspectives on water use that arose during the market revolution. Charles Sellers noted that in establishing their mills, factory owners "needed law that gave new and dynamic forms of property, particularly transportation and manufacturing facilities, priority over static forms of property, particularly agricultural land" to subsidize the development of their works.[15] At the same time, once the factories and canals came into operation, these dynamic forms of property needed to stabilize and ensure that the contractual agreements regarding water use remained intact. Thus, Sellers noted that mill owners argued for "absolute freedom of contract coupled with absolute

14 Carol Rose, "Property as Storytelling: Perspectives from Game Theory, Narrative Theory, Feminist Theory" *Yale Journal of Law and Humanities* 2 (1990):37-57 argued that the right to property exists because of a collective agreement to tell a common story about its nature; Margaret Radin, *Contested Commodities* (Cambridge, Mass: Harvard University Press, 1996) described the importance of plural, often contradictory understandings of commodities including property.

15 Charles Sellers, *The Market Revolution: Jacksonian America, 1815-1846* (New York: Oxford University Press, 1991) p. 51; Brian Donahue, "'Dammed at Both Ends and Cursed in the Middle:' The 'Flowage' of the Concord River Meadows, 1798 – 1862," *Environmental Review: ER* 13, no. 3/4 (October 1, 1989): 47–67; Theodore Steinberg, *Nature Incorporated.*

enforcement of contract"[16] to prevent the subsequent appropriation of their own water. They maintained this argument even when it entailed reading a mill grant from the seventeenth century in the terms usually reserved for a contractual relationship in water use during the nineteenth century. While they continued to rely on historically grounded mill rights, they began to use them in a fashion detached from the community prerogatives that had surrounded mill grants when they were originally issued.

The following four sections explore the details of particular cases that illustrate how small mill owners depended on historical understandings of water use to guide their production practices. Attention to the specifics of how these mill owners used water illustrates how industrialization proceeded in communities that primarily viewed the flow of water as a function of time, and not space. These cases help to answer the question of how knowledge of the history of water's flow and working practices grounded in the active management of ongoing flows came to define the adjudication of water rights along the river's tributaries. Getting into these details will help to illustrate the barriers to development that prevented the centralization of water management on the Connecticut. They will explain why people in the Connecticut Valley thought in terms of river reaches and floodplains rather than watersheds. Further, they help to explain the survival of improvised water management strategies that defined work at small mills amidst the growth of larger mills.

16 Charles Sellers, *Market Revolution*, p. 51.

Mercy Hatch v. Josiah Dwight et al. (1821)

Mercy Hatch v. Josiah Dwight et al. pitted the owner, by foreclosure, of a historic mill right against her defaulters. Before defaulting on the mortgage, the mill owners moved the milldam downstream beyond the bounds covered by the mortgage and then raised it to a height that flooded their old dam site. Thus, Hatch sued Dwight to recover damages for flooding a mill dam that had ceased to exist because Dwight had rearranged the landscape. In this sense, the conflict exemplified the tension between historical water rights and contemporary water uses. Hatch claimed the property based upon the value that it held in 1807 on the date of the mortgage's issue, but Dwight and his codefendants argued that she could only be compensated for the property in its present flooded and unusable state. The case turned on the question of where the judges found the value of a mill in both space and time. Was it located in the land over which the water flowed; in the right to use the water; or in the water itself? Was it the value at the moment that the case was filed; at the moment when Hatch issued the mortgage; or at some intermediate point?[17]

The history of the case began in 1799, before either Hatch or Dwight arrived on the scene. Between 1799 and 1817, William Edwards owned and operated a tannery on the banks of the Mill River in Northampton. It seems likely that he owned it during good economic times and leased it from his creditors during lean times.[18] The array of tanning vats that he had arranged along the Mill River drew its water while the power generated by an adjacent fall line mechanized the grinding of tannin-rich tree bark. For access to this water, he depended on a

17 *Hatch v. Dwight* at 288.

18 A similar arrangement is described in Donna J. Rilling, *Making Houses, Crafting Capitalism: Builders in Philadelphia, 1790-1850* (Philadelphia: University of Pennsylvania Press, 2001).

string of mill privileges bought from the operators of old grist and saw mills.[19] Working in concert with investors from Boston, Edwards retooled this business by buying up three competing upstream water rights. Later, in June 1807 he borrowed one thousand dollars from Mercy Hatch, using one of the upstream mills—a dilapidated grist and saw mill—as collateral. In October of that year, he sold two thirds of the water rights to this upper mill to Joseph Burnell, who planned to remove Hatch's mill and use its materials to expand his dam. This dam would then flood Hatch's mill site with the pond of his own dam downstream. In 1810, Edwards renegotiated his mortgage with Hatch, reserving a tract of land alongside the mill site independent of the mortgage's encumbrance for the establishment of a new tannery. Later, in 1815, Edwards sold the final third of the water rights to Josiah Dwight, noting its encumbrance by a mortgage in the deed. When Burnell and Dwight examined their deeds and the mortgage in 1817, they discovered that their dam sat downstream of the dam described in Edwards' mortgage and concluded that Hatch only owned the rights to a mill site that they had abandoned. They defaulted on their mortgage and Hatch foreclosed.[20]

In 1817, Hatch's property was literally underwater, and she sued Dwight and Burnell for the interest on the value of the mill, effectively seeking to replace the mortgage with an annual settlement for flowage. This litigation continued into 1821. During the fourteen years before the suit, Edwards had built his tannery with capital from a mortgaged mill and the sale of that mill's water rights. His downstream neighbors, Burnell and Dwight had bought those rights and used them to expand their own mill, whose outputs go unmentioned, but whose place in the overall

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19 Agnes Hannay, *A Chronicle of Mills on Mill River* Smith College Studies in History, no. 21 (Northampton: Smith College, 1936); *Hatch v. Dwight* at 289.

20 *Hatch v. Dwight* 288-291.

scheme is quite clear. Dwight and Burnell had appropriated the materials from what would become Hatch's mill and the power of what would become her millpond to run their own factories. The right to water power passed between the hands of four owners, providing a source of capital and a source of power in the establishment of three businesses. The only question that remained was whether these mill owners needed to compensate Hatch for flooding her land.

Hatch held the title to the upstream land after foreclosure, but the indicators of the land's value did not exist in the present. Historically, her mill site had been the location of a corn mill chartered by the town of Northampton to provide for their needs as a community. Indeed, the defendants argued that this obligation to provide grist milling reduced the value of the mill site.[21] This contributed to the controversy over value of the land, fueling the question of whether the mill's valuation ought to be taken at the time of foreclosure or at the time of the issuance of the mortgage. When Edwards took out the mortgage in 1807, a mill still stood on the land that guaranteed the mortgage and Hatch seems to have believed that the instrument that she held would remain valuable despite the extensive modification of the landscape. Burnell and Dwight, on the other hand, believed that their work would make it possible to limit the coverage of the mortgage to the property that formerly held the mill. Moreover, Burnell and Dwight argued that Hatch could not file an action under common law for flowing property because the mill acts had superseded the remedy under nuisance law. At work in this argument was both the logic that the common law provided for more extensive damages and nuisance abatement, and the logic that Hatch had no claim grounded in the harm caused by Burnell and Dwight's removal and relocation of the dam. Hatch's treatment of the mill as a nuisance reflected its hybrid status as a

21*Hatch v. Dwight* at 291.

form of collateral and also a real piece of property. Moreover, they ridiculed Hatch's complaint as an action "for flowing an ancient site for a mill, on which no mill is standing."[22] This made the suit into a question of whether the historical presence of a mill on this property mattered more than the landscape after the mill's removal.

The court insisted on the significance of the site's historical status as a mill. Isaac Parker, the chief justice of the Massachusetts Supreme Judicial Court, looked askance at Burnell and Dwight's argument that Hatch had abandoned the mill. Her status as an agent in charge of the property dated only to her foreclosure, and "as soon as she entered to foreclose, she had a right to the full use and value of the privilege as it was when her title commenced."[23] Parker's opinion ruled that the value of Hatch's mill site lay in its legacy codified by a mortgage rather than the remaking of the place of milling carried out by Burnell and Dwight. Interestingly, the court did not opine on whether the ancient mill right that Dwight held still obliged any mill owner working in that space to grind corn. They focused on keeping the historical status of this mill in the present consciousness because it prevented the use of water law to defeat the spirit of a financial obligation. In a certain sense, this promoted the system's stability over the interests of individual industrialists.

The court based its decision in the history of the mill site, as codified in a mortgage contract. Nevertheless, this did not constitute the use of a contract to unleash the creative power of industry. Instead, it defended finance against the appropriation of a water right for industrial development. Justice Parker effectively nullified Burnell and Dwight's default by imposing an

22 *Hatch v. Dwight* at 293.

23 *Hatch v. Dwight* at 297.

ongoing obligation to pay interest on the value of Hatch's mill site even if they never planned to pay the principle of their mortgage. In this sense, Hatch's mortgage gave her a right to the use of the mill as it stood before Dwight and Burnell's default. While the defendants believed that they had modified to landscape to eliminate the financial risks associated with default, the court enforced a right to the landscape as it had been. In this sense, the court's decision erected an effective barrier to the passage of time at the upper mill. Even if the court could not make the lower mill owners take back the property, it could impose an ongoing financial obligation analogous to interest on a mortgage. The rejection of the mill acts as a recourse—Dwight's argument having been that the common law did not provide a venue for action in a case about flowing—transformed this suit into a discussion of how the distinction between property in land, structures, or water related to one another.

As such, this case helped to explain some of the key elements in how Connecticut Valley residents saw the landscape and its potential for transformation. The limitations on capital that drove Edwards to take out this mortgage and encouraged Burnell and Dwight to reuse the materials that had made up the dilapidated mill reflected the broader limitations that low capitalization created for manufacturers working at small fall lines.[24] They saw water, building materials, and credit as objects to shepherd intensively in support of their manufacturing efforts and this contributed to their willingness to make and remake the landscape—an approach to manufacturing that contrasted with the apparent solidity and permanence of mills in more

24 Leonard N. Rosenband, "The Many Transitions of Ebenezer Stedman: A Biographical and Cross-National Approach to the Industrial Revolution," in *Reconceptualizing the Industrial Revolution*, ed. Jeff Horn and Merritt Roe Smith (Cambridge, MA: MIT Press, 2010), 201–28; Philip Scranton, *Proprietary Capitalism: The Textile Manufacture at Philadelphia, 1800-1885* (Cambridge: Cambridge University Press, 1983) p. 8-9 describes an analogous situation;

established factory towns. In dealing with a conflict over flowing a mill that no longer existed, this case illustrated the uncertainty concerning the nature of a water right in 1821. Did it adhere to the land upon which the water flowed, to the mill, or to the water itself.

Theodore Bliss v. Charles G. Rice et al. (1835)

Theodore Bliss v. Charles G. Rice et al. pitted two co-owners of a sawmill against each other. While Bliss operated the sawmill as his predecessors had since it received its charter in 1638, Rice took his share of the water and redirected it into a flume running from the sawmill's pond to a lead foundry on the opposite bank of Springfield's Mill River. Moreover, Rice contended that there were two types of water in the stream, the flow ponded below the height of the dam—which belonged to whoever exercised the water right at a particular moment—and the waste water running over the top of the dam—which remained unappropriated. In accordance with this theory, Rice appropriated the portion of the water running over the top of the dam by structuring the gate to his flume so that its height paralleled the top of the dam. Bliss countered that there was only one type of water and that "the appropriation and the use had been co-extensive; that the portion of the water which flowed over the dam contributed to the effective power of the pond and was a part of the appropriation."[25] While Bliss argued that the historic flow of water ought to shape its present use, Rice countered that changes in the landscape and practices of water use ought to enable new approaches to water use.

Like *Hatch v. Dwight*, this dispute concerned whether the transformation of the millsite as a place violated the historical relationships that had governed the flow of water. Unlike *Hatch*

25 *Bliss v. Rice* at 30.

v. Dwight, the court brought a broad range of historical sources and considerations that to bear on its analysis of the problem. *Bliss v. Rice* pitted two interpretations of how a historical right to water set limitations upon the configuration of a millpond against one another. Each of these interpretations rested on an independent array of evidence speaking to the history of water use at the site. Each of the disputants wondered how exactly the historical relationships established in the charter to the mill ought to determine the rights to water for the lead foundry.

The court considered four different types of evidence in this case, much of it consisting of historical documentation. Title deeds and receipts for water use spoke to the property relationships that defined the site's recent history. Testimony from the neighborhood's oldest inhabitant and two of the mill operators familiar with the historical flow of water established the public memory and understanding of water's flow through the site. Documentary evidence of grants from town meeting and subsequent tax assessments defined the history of the site's use as a mill. In weighing these different sources on the history and memories of water use in the region, Supreme Judicial Court Justice Samuel Putnam judged how the history of water use at this site ought to be assessed and whether this should define the uses of water power that were permissible in this place. Thus, the historical water uses within the mill site went on to define who owned the rights to water and determined how water could be shared along the banks of this particular millpond.[26]

Rice sought to open up the possibilities for water appropriation and use at the mill site, so he formulated an argument that reset the appropriation of water in the recent history of water use. The site of the sawmill on the Springfield Mill River consisted of a milldam with a sawmill on

26 Ibid at 25-27.

the north side of its pond. While the earthen bank on this side made it simple to cut a channel from the pond over through a flume feeding a mill wheel, the bank on the north side was generally understood to be "too steep, rocky and abrupt" for development—not unlike the red sandstone at South Hadley Falls that Timothy Dwight had described as "too hard to be easily dug and too loose to be blown."[27] Much like the canal at the falls, nobody tried to excavate a channel through the sandstone at this millpond until the first decade of the nineteenth century. Because this bluff stood as barrier to development until 1809, when Asher and Pliny Bartlett excavated a channel running from the millpond to their forge, Rice believed that the sawmill's grant to the full water of the Mill River no longer held because of the technological changes that had made it possible to excavate a flume and utilize the water on the south side of the pond. While the Bartletts might have rented this water as surplus from Jonathan Dwight, the mill owner who preceded Bliss and Rice, such rentals did not necessarily need to continue because the new possibility of digging a channel on the north side had opened up what Rice saw as a new horizon in the division of water rights. Rice argued that this previously unimagined flume redefined the water rights in the region by creating the possibility of accessing water on the north side of the dam. Thus, the sawmill itself could only own the right to the water already appropriated by its dam and flume, while any water running over that dam remained available to a riparian proprietor interested in exercising that water right.[28]

27 Ibid. at 28; Timothy Dwight, *Travels in New England and New York* (New Haven: Timothy Dwight Jr., 1821) I:323; for maps noting the geological origins of these landscapes see "Connecticut River Basin" Geology of National Parks 3D and Photographic Tours USGS http://3dparks.wr.usgs.gov/nyc/mesozoic/connecticut.htm; See also the Bedrock Geology dataset at Oliver, MASSGIS online mapping; This also occurred roughly contemporaneous with the growth of quarrying in the valley, Alison Guinness "The Portland Brownstone Quarries" *Chronicle of the Early American Industries Association* 55 no. 3 (September 2002):95-112.

28*Bliss v. Rice* at 32.

Rice's geological and technological evidence provided the basis for part of his argument, but this only accounted for the surplus water that he had appropriated. He also owned a portion of the sawmill as a tenant in common. This raised the question of whether he held a unified title to the dam site, enabling him to make an appropriation of water, or if it would prove impossible to unify the clear title to the north bank with the title as a tenant in common on the south bank of the pond. Such unification would strengthen Rice's claim to the pond. When Dwight sold the sawmill to Bliss and Blake, Bliss acquired nine twenty-fourths of the mill and Blake acquired fifteen twenty-fourths of it. This system of dividing the water rights provided a basis for dividing the water based upon days of work on a twenty-four day cycle. If we assume that they observed the Blue Laws and did not operate on Sunday, this created water privileges that would recur every four weeks. Blake initially provided Rice with permission to use his share of the water and ultimately sold his rights to Rice. Rice believed that he ought to be allowed to operate his mill with no restrictions so long as he left adequate water for Bliss to operate the sawmill during the nine days out of twenty four that he held the right to the water.[29]

Bliss countered that Rice acted as a tenant in common, and thus held title to use rights associated with the mill, but not an unfettered right to appropriate water. This logic limited Rice's ability to appropriate the water flowing over the dam on days where Bliss exercised his right to the sawmill. In defending the integrity of the sawmill's right to operate, Bliss brought together three historical points. He argued that the mill possessed an ancient grant, that the mill had been operating based upon that grant more or less continuously, and that the establishment of the flume across the millpond did not reset or change the water rights in that grant. To defend these

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29 Ibid. at 29.

positions he cited evidence from the town meeting indicating the grant of the mill site in 1638, evidence of the construction of the earliest known mill – described in the tax assessment of 1742, and evidence that previous owners of Rice's land had paid rent on the mill. In addition to these written proofs, he brought in the testimony of the neighborhood's oldest inhabitant, a man named Obed Lombard, who confirmed his story. This argument rested on the glue of a supposition that the history of a sawmill ought to be interpreted according to the custom of local residents living in the vicinity of this mill. Bliss rebutted Rice’s claim that the nature of the place had changed in the recent history of the river by reference to a concordance between the records of the town meeting, tax assessments, and the local memories of water use.[30]

In addition to arguing for the historical integrity of the mill site's appropriation as a sawmill, Bliss presented a description of the place that allowed for no subdivision of the water. He argued that the process of digging a flume through the loose and rocky soil of the pond’s north bank threatened to erode the bank itself and cut a new channel around the milldam. At the same time, his sawmill operators testified that the flow of water over the dam increased the velocity of the saws in the mill and increased production, indicating that this water was not wasted. This description of the millpond as a place limited the flexibility of its operations and suggested that Rice might actually need to cease operations altogether.[31]

Justice Samuel Putnam issued a split decision. He supported Bliss' claims about the history of the mill grant and rejected the theory that the novelty of a new flume reopened the process of appropriating water. At the same time, he rejected the argument that Rice’s flume

30 Ibid. at 32

31 Ibid. at 35-38

threatened the structural integrity of the milldam itself. He based his support on attention to the historical memories of water use that appeared in the trial record. They noted that William Pynchon had conveyed the land as a mill lot in 1654 and that there was evidence of its use as a mill in 1742. To draw in the remainder of the history, he drew on the testimony of Obed Lombard, a sixty-eight-year-old man from the neighborhood who noted that nobody had contested the sawmill's claim to water rights even as the Bartletts had developed Rice's property as a forge in 1809. This indicated that the historical uses of the water held precedence even if changing technologies for excavation made the creation of a new form of flume possible.[32]

The decision of these legal cases depended on how the court interpreted the history of water use, what evidence it privileged and what evidence it marginalized. In this sense *Bliss v. Rice* confirmed a historiography grounded in an ancient right dating to the seventeenth century and whose interpretation in the early nineteenth-century reflected the continuing relevance of the mill in its relationship with the local community. At the same time, this occurred in a fairly narrow context. Rice argued that the sawmill operators could not act as witnesses to the importance of the water's velocity because of their own status as employees of Bliss interested in the outcome of the case. This argument went unanswered, indicating that the sawmill operated as a private concern producing for the market rather than a public concern serving the custom of the country. Indeed, while the historical memory of the mill's ownership and use provided Bliss with the right to maintain the mill with an attendant right to its whole water, the court also maintained that this water did not necessarily need to be used in sawing lumber, and indeed that any use whatsoever might be grounded in this ancient right. This distinction in the significance of an

32 Ibid. at 32.

ancient right—that it buttressed the private use of water but did not guarantee public rights—would prove significant in the next case under consideration

Inhabitants of Hadley v. Hadley manufacturing Co. (1855)

Inhabitants of Hadley v. Hadley Manufacturing Company featured a conflict over water use where financial instruments grounded in a mill's recent history conflicted with the historical memory of ancient water rights. In *Hatch v. Dwight* and *Bliss v. Rice,* the court read history in two distinct ways when making their legal analysis. *Hatch* discussed the use of historically grounded financial instruments to define the character of a landscape while *Bliss* discussed the use of historical grants and practices to define its character. If contracts took precedence over historical grants, then the historical grants would be read contractually. Otherwise, the historical grants, read as guarantees of community norms regarding water use and situated by the testimony of the granting town rather than the mill owner or the bare written record. A contractual reading of the historical record provided less flexibility than a customary reading. Custom remained subject to errors, adaptations, and modification in line with the stories that animated community life, while contractual readings of history subjected written records concerning water use in the eighteenth century to the strictures that governed analogous contracts or bills of sale in the nineteenth century. While relying on historical memory vested the obligations and practices of a mill owner in the hands of the community, relying on contractual logic vested the operations of a mill in private hands. Faced with these two means of explaining the rights and obligations of a dam owner, the court needed to decide which historical perspective held water. The court's decision ultimately reflected a willingness to prioritize the language of an 1834 deed over the series of grants and public memories that argued for a higher obligation grounded in the relationships that preceded this sale.

An array of historical evidence gained through community life bolstered the town of Hadley's case. They worked to trace the Hadley Manufacturing Company's title to their dam on Fort River back to its initial grant in 1750, which had specified "that they and their heirs and assigns should erect and maintain a grist mill on the same, in good repair."[33] This proved impossible because "Early papers and records, important witnesses in the case, bear unmistakable evidence of the hands of time upon them."[34] The deterioration of the written record weakened the town's case. Consequently, a gap separated the memory of the terms of the mill grant from the verifiable paper trail associated with that grant. The town could find subsequent records indicating that in 1753 they had added an obligation to build a causeway and bridge across the river below the dam, and that in 1786 they had authorized the modification of this causeway for the purpose of building a sawmill, but these easements said little about the nature of the underlying property. David Pomeroy supported the town with testimony that his father, Angel, had refused to saw his son's timber because he believed there was only enough water in the pond to mill grains for the inhabitants of Hadley.[35] Thus, the Pomeroys, who owned the mill until 1834, treated the grant as an obligation to serve customers from the town ahead of any other projects they envisioned as a mill.

We might reasonably ask, however, why a grist mill seemed important to the town during the 1850s. Grist mills sat awkwardly on the landscape of a town well enough integrated into the

33*Hadley v. Hadley Manufacturing Co.* at 141.

34 Hadley Town Meeting Records, 18 March 1853, v. 23 p. 40.

35 Ibid.

market to be making the transition from one cash crop, broom corn, to another, tobacco. Wheat did not play a major role in commercial agriculture—as the wheat coming out of the Erie Canal had undercut subsistence production decades earlier. Instead of providing a means of marketing farm goods or reflecting a transition from subsistence production to capitalism, the wheat fields of Hadley farmers provided a means of buffering the farm family from the market in an era defined by agricultural capitalism. As one Hadley farmer argued the growing of wheat involved "other calculations than profit."[36] In the panics of 1837, 1847, and 1857, farmers in bottomland towns such as Hadley acquired a skepticism about the cash economy, and touted the virtue of growing their own crops of wheat to avoid dependence on the cash economy. In their minds, this was part of a broader effort at reclaiming their subsistence roots.[37]

A mill owner could be forgiven for dismissing these claims as dangerous anachronism. While farmers might fear the vagaries of the cash economy, their own wheat crops faced numerous problems with pests and wheat rusts.[38] The fact that grist and saw mills often focused on custom production compounded the uncertainty underlying grist milling. They operated only intermittently when they had customers. By contrast, manufacturing operated independent of local demand and focused on continual engagement with the landscape. This made grist mills a means of hedging against the uncertainties surrounding the cash economy. If the bottom fell out of the tobacco market a family's self-sufficiency in grains provided a means of surviving the lean year, but this insurance presented a privilege to farmers in the region at no small cost to the mill

36 Horace Russell, quoted in North Hadley Farmer's Club, records, 21 January 1857, UMass.

37 Clark, *The Roots of Rural Capitalism* 309-10; Ellen Callahan, *Hadley, the Political Development of a Typical New England Town from Original Records* (Northampton: Smith College, 1930) p. 25

38 North Hadley Farmer's Club," records, 21 January 1857;

owners who sought to maximize the benefits of their millponds. This proved especially contentious because a good year for wheat, with a relatively dry summer leading into the harvest, would be a bad summer for mill operations due to the summer's dryness. Thus, a dry summer in Hadley revealed a simmering conflict over the nature of the Hadley Manufacturing Company's water rights.

The Hadley Manufacturing Company thought that they had received a release from their obligation to operate a grist mill in the process of acquiring the millsite itself. In some respects, the town meeting agreed with them, noting that the Manufacturing Company's title, purchased in "1834 is a warrantee of the very largest kind with no reservations and free and clear of all encumbrances whatsoever."[39] The Pomeroy family, who had been longstanding owners of this mill, had historically provided grain and lumber milling services to townspeople upon their requests, neglected to include these obligations in the title. The Hadley Manufacturing Company expanded the mill to provide power for the production of children's wagons, tanning, and paper production, in addition to trying to meet the town's demand for grist and saw milling.[40] This diversification might have increased the performance of the mill company, but these water uses also competed with grist and saw milling.

The residents of Hadley initially took an interest in this case during the spring of 1853, but they did not face off against the Hadley Manufacturing Company until the droughty summer of 1854. Amidst reports that the apple season looked dismal and the upstream mills in towns such as Amherst were shutting down for lack of water, residents of Hadley brought their grain to

39Hadley Town Meeting Minutes v. 23 p. 40 18 March 1853.

40"History of Western Massachusetts: Part III, no. 14" *Springfield Republican* (16 October 1854) p. 1. "Local Items: Amherst"; *Springfield Republican* (26 August 1854) the Hadley Manufacturing Company. Upon the refusal of the company, which was itself watching the level of its pond, the town filed a suit against the company, pitting their account of history grounded in memory and custom against the company's account of history grounded in the title deed. The court needed to decide whether community relationships that undergirded the mill's operations over the last century take precedence over the terms of sale that had been established two decades earlier

The court ultimately decided that the language in the title of ownership should determine how the language of historical custom should be interpreted. The title provided a certain description of the mill as a place where certain contractual obligations would be fulfilled. However, when they applied this standard to the accounts of historical relationships that defined the town's rights, the courts reinterpreted their documents. Justice Lemuel Shaw focused the court's attention on the town's claim to own the land underlying the mill. The central issue in his mind was whether the town had granted the land upon the condition that its owners maintain the mill, a circumstance that could justify the town in reclaiming the land if the mill ceased to serve the town. Without this original title in fee from the 1750 mill grant, they could not reenter and reclaim the property in 1854. In order to meet these demands, the court concluded that "as such a claim, founded on strict law, tends to defeat an estate on which there may have been made great improvements, and after a great lapse of time, every proposition necessary to such title must be established by them by strict and satisfactory proof."[41] This standard proved difficult to establish because "so many divisions to individual and to companies or classes have been made, so many pitches and settings off, so many dedications of land for highways, so many votes authorizing

41 *Hadley v. Hadley Manufacturing* at 141

changes of location and making compensation for inequalities, that it requires a close attention to the localities and to the application of various votes and records, collected and submitted, to come to a satisfactory result."[42] The town could not overcome the problems of disorganization in their records to establish their clean title in the land at the date of the grant. Indeed, the court read the 1750 vote granting the mill's first owners "liberty of erecting a grist mill on Fort River near Lawrence's Bridge, with the use of said stream, so long as they shall keep a grist mill there in good repair"[43] as an established water right that logically followed from their ownership of the land, but did not necessarily reflect the town's grant of the land. Instead, the court argued that this vote reflected the town's consideration of whether the mill should be set in the right of way of a public highway then running across Lawrence's Bridge. Shaw went on to speculate that the initial mill had used the same abutments as Lawrence's Bridge to dam up the stream, conserving the timber and other resources that went into stopping up some river.

Theoretically, if the town's non-ownership of the land granted was sustained, the company might still face a judgment for their inability to run a gristmill. Having rejected the customary account of history associated with the town's claim regarding the land, the court went on to argue that the company might have an obligation to mill grain, but nothing in the language of their grant indicated that they faced any consequences for being unable to mill grain. Moreover, despite David Pomeroy's testimony, the court concluded that "if they intended that they should grind for the inhabitants of the town, rather than the inhabitants of other towns, it is not expressed; no provision is made that they shall grind for customers rather than the market. All this was left to be regulated by the usages of the country and the laws in force regulating

42 Ibid. at 142.

43 Ibid. at 143.

mills. Probably the grantors thought that, if a corn mill was erected there and kept in good repair, it would be so much for the interest of the owners to grind for the neighbors, that they might safely rely on their own self interest to accommodate the neighborhood."[44] Thus, in order to maintain the status of the mill on the Fort River as a custom mill that served the people of Hadley preferentially, the initial grant of the mill would have needed to include language establishing these conditions at the outset rather than relying on memories of historical use to establish present day obligations. In essence, this construction imposed a modern—that is to say mid- nineteenth- century standards—of water right construction on a grant made in the mid-eighteenth century.

Pratt v. Lamson (1863)

The court's practice of reading customary arrangements like contracts coincided with the growth of reasonable use doctrine. Both of these legal practices enabled the cutlery firm Lamson, Goodnow and Company to abrogate a grant that they had inherited when purchasing their mill site at Shelburne Falls along the Deerfield River. The lawsuit arising from this grant concerned the definition of waste water, the plaintiff claimed that this designation reflected the historical relationship between water users when he initially built his mill, where he possessed the youngest water right with the least seniority, and therefore he received the water otherwise wasted by more senior users, but theoretically he could accrue seniority. By contrast, the defendants argued that waste water referred to the water over and above the amount used by upstream consumers. Thus, the case pitted an explanation of the property right grounded in historical contingency against an explanation of the property right grounded in spatial

44 Ibid. at 145.

contingency. If waste was historically contingent, its definition changed over time. If it was spatially contingent, it would not change in time, but rather it consisted of all the water above and beyond what the upstream users could consume with their works, but never gaining seniority as a water user.[45]

David Crittenden owned the initial mill right at Shelburne Falls and he used the water to operate a grist and saw mill. He held back part of the river with a wing dam that ran across half of the river and drew the water ponded behind it into a small flume. He served local farmers through the 1820s, but also began subdividing the surplus water available at that site. In 1823, a forge bought part of the water power to produce rakes. In 1836, another forge bought part of the privilege so as to produce scythes. Finally, on June 28, 1843 Josiah Pratt acquired a deed to draw two hundred square inches of water at a head of fourteen feet from the top of the flume drawing water to the original grist mill for his axe factory. As constructed, the right enable Pratt to acquire water from the grist mill after the neighboring rake factory, and scythe factory had received their water.[46]

Crittenden sold his mill site to Lamson, Goodnow, and Company, a manufacturer of cutlery, in the late 1840s. In 1851, Lamson and Goodnow built a new dam above the wing dam that appropriated the whole flow of the river and eliminated the flume that had fed Pratt's privilege. In the process of building this dam, they had acquired the properties that belonged to the scythe and rake manufacturers, and the land on the south side of the river that would complete their title to whole flow of the stream. They rebuilt the dam whose excess water had

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45*Pratt v. Lamson* 275

46Ibid. at 276-8.

formerly fed Pratt's flume and expanded their operations to dominate Shelburne Falls.[47] Pratt sued Nathanael Lamson and his partners so as to recover access to the water.[48]

The central question at work in this case concerned whether the grant made in Pratt's title described water use in a specific place—Crittenden's flume—or the right to water at a specific time—subsequent to its use by upstream rights holders. Was Pratt's title frozen in its junior position as a grant to a place that historically produced waste water or had it accrued seniority as the two forges ahead of it in line ceased operation? In other words, did the title attach itself to the water wasted by Crittenden's wing dam and disappear when Lamson Goodnow built their run of river dam upstream? These questions bear upon the broader question of how mill owners could modify their production processes in contexts where water-sharing agreements seemed to limit their flexibility. Perhaps more interestingly in this case, Pratt argued that Lamson had granted waste water—water channeled by his flume, but not consumed—as a water right, while Lamson countered that the idea of waste was contingent on the broader water use practices associated with his factory. If Pratt had prevailed, it would have created an obligation that Lamson continue 'wasting' water, effectively locking his mill into a production process that existed at the beginning of the contract. Lamson and Goodnow argued that Pratt's title only applied to wasted water while Pratt argued that the title actually meant that he ought to be able to access all of the water over and above the equivalent amount of water that had been consumed during the operations of the previous businesses that had been bought out by Lamson and Goodnow. This case took on a special significance because Lamson and Goodnow had begun selling the water

47J. Ritchie Garrison, *Landscape and Material Life in Franklin County, Massachusetts, 1770-1860* (Knoxville: University of Tennessee Press, 1991).

48*Pratt v. Lamson* at 277-9

backed up by their new dam to other factories. Pratt complained that this created rights which would be junior to his claim and therefore ought not to acquire water prior to his accessing it.[49]

Lamson argued that the water privilege owned by Pratt amounted only to a right in waste water and the right to that wastewater adhered to the flume on Crittenden's mill rather than the new dam and factory. Moreover, Lamson insisted that the problems encountered by Pratt resulted entirely from the repair of the upper dam, where leaks and fissures in its operation had made water available to Pratt's mill in a volume sufficient to operate his axe shop, but that such a water right would necessarily expire when Lamson repaired the dam.[50] This argument would have rendered Pratt's claim to water virtually meaningless because the approach that Lamson, Goodnow & Co. took to managing the dam entailed rebuilding the upper structure entirely. The court sided with Lamson, agreeing that Pratt's title attached only to surplus water over and above the amount that had been consumed by Lamson's wheels. Thus, the concentration of water rights under exclusive and singular proprietors was intended to encourage development by limiting questions about ownership, but, in fact, any contracts signed under such circumstances would require continual renegotiation and reorganization as riparian owners maintained and rebuilt their structures.[51]

The sale of a right to waste water indicated an effort at taking a traditional mill right and maximizing the exploitation of the water that it described, but it also left an open question of what it meant to own the right to waste. Would that right include a right to prevent maintenance? Could the owner of a dam who did not own the dam's waste water rebuild or repair the structure

49Ibid. at 280-1.

50Ibid. at 291.

51Ibid at 289-91.

if this increased efficiency to a point where it left the subsidiary right worthless? If not, did this mean that the upstream dam owner needed to negotiate the renovation and repair of the dam with the downstream water user? In essence, if the promise of wastewater held any significance in the eyes of the court, there would be an open question of whether dam owners who sold waste water had any right to rebuild or repair their dams under any circumstances. This proved to be a limitation that went too far in the eyes of the court, and they ultimately ruled that contracts for waste water use were contingent on the visibility of actual waste. Visibility proved an especially pertinent element in this ruling because Lamson and Goodnow physically enclosed the works through which they consumed the water, making the volume of their water use impossible to even estimate so as to begin a new claim against them.[52]

The court judged that the central question was not whether Lamson and Goodnow had taken any actions that limited the availability of water for the defendants. Instead, they ruled that Lamson and Goodnow should calculate their water right relative to an alternative scenario where the mills on the Shelburne side of the falls retained the same status while the mills on the Buckland side of the falls consumed half of the total flow of the river. When Lamson and Goodnow took over the whole of the stream, did they accidentally or purposefully create a network of flumes that appropriated the surplus water that had formerly fed Pratt's flume. On the face of it, this would obviously be true because Pratt would not have sued if he had not lost his water, but it was also incredibly difficult to prove. Pratt complained that "the defendants have so changed their works and applied the water used in priority to the plaintiffs to new purposes as to deprive the plaintiffs of all proper means of ascertaining their measure or comparing it with the

52 *Pratt v. Lamson* at 460.

present use."[53] The plaintiffs had grounded their argument in a description of the state of Crittenden's mill, describing "new and additional, and more regular and exhausting uses of water, and the size and number of the gates in the old grist-mill and saw-mill, the comparative amount of waste and leakages of water, and the recent improved methods of using it."[54] Pratt went on to argue that the design of the new mill hid the gates and flumes that took in water for consumption at Lamson's mill, enabling them to use Pratt's water while claiming that they only used as much water as they had previously consumed. Ultimately, the court left Pratt in the unfortunate position of having lost access to the surplus water that formerly flowed to his mill, but also to the means of determining how the water he formerly depended upon had been appropriated.

Conclusion

In the course of industrial development, the courts increasingly treated customary water uses as merely another form of contract. In the process, customary water rights became valuable resources for establishing new manufacturing sites in the Connecticut Valley. Contracts for water-sharing provided capital and support for the growth of manufacturing, but at the same time, they also placed obstacle in the path to development over the long run. It was not necessarily impossible to overcome such obstacles, but nevertheless their presence did help to set the pattern of industrial development in the Connecticut River Valley. Rather than attracting large centralized manufacturing towns which controlled watersheds, the majority of mills along the Connecticut and its tributaries consisted of clusters of small manufacturers organized along their

53 Ibid. at 460.

54 Ibid. at 460.

numerous fall lines. Each of these mills adapted their dams and mill ponds to share water amongst themselves.

If the court made the shift from custom to contract so as to foster industry, it did so in half measures. In cases such as *Bliss v. Rice*, judges pitted the production of industrial materials against more traditional processes of commodity production, and the court sided with less technologically innovative approaches.[55] Indeed, even in the case of *Hadley v. Hadley Manufacturing Company*, which pitted farmers against mill owners in a legal conflict seemingly designed to illustrate how communities chafed at the limitations of the market, the status of traditional subsistence- oriented milling as an adjunct to cash crop production in the minds of local farmers indicated that this suit concerned how water ought to be used in the fostering of a market economy rather than whether it was worthwhile to have a market economy in the first place.[56] This refocuses questions about how custom stacked up against contract so that they represent competing approaches to development rather than pitting an argument for development against an argument for stasis.[57] The cases considered in this chapter mediated how dam owners ought to share their water power rather than debating whether they ought to have water power in the first place.

When the courts enforced strict readings of contracts they discouraged improvements in the measurement of water's flow. Mill owners along the Connecticut River's tributaries did not approach the distribution of water by estimating the total volume available and then attempting to coordinate their appropriations in terms of that total amount. They did not have the technical

55 *Bliss v. Rice*

56 *Hadley v. Hadley Manufacturing Co.*

57 cf. Hurst, *Law and the Conditions of Freedom*; Horwitz, *Transformation of American Law.*

means to understand the amount of water consumed by an individual mill or the amount of power that this mill generated. They did not have a means of estimating the total flow of a river, or connections between flow and rainfall or watershed size. In essence, they relied on rules of thumb and historical understandings of water use to quantify their appropriations. When challenged in court, they defended their claims to water based upon the historical memory of who had previously claimed water or the terms of contracts that spelled out these rules of thumb. This created a landscape of industry where the practices of water use would have been legible to ordinary millwrights throughout the region, who would be able to understand the ideas behind any mill's water consumption patterns by examining the millpond alone.

Even as factory owners shifted the legal basis of their operations to contracts, they did not necessarily look at water in new ways. Instead, they looked to the history of water use to determine its future uses. They measured water's flow historically rather than engaging in the spatial and quantitative measurement of its flow across the watershed. The cases considered in this chapter describe how the practices of water-sharing underlying these contracts could paper over deep-seated conflicts between neighboring water users. These conflicts illustrated how contracts could create barriers to development. The terminology used in contracts locked in specific technologies and infrastructures of water use independent of the changes going on in industry.

A mill that hewed to the specifics of its water rights as established by contract had a right to refuse innovations in the metering and distribution of water. In some respects the judicial preference for the narrow interpretation of contracts militated against the establishment of quantitative accounts of water rights that could facilitate the establishment of corporate bodies capable of commodifying water power. Thus, grounding water use in contracts actually played a conservative role in preserving the flow of water, creating new challenges for water-sharing that arguably slowed efforts at turning water into a commodity along the Connecticut River. We will see in the next chapter that it was only when the new city of Holyoke, a factory complex launched with wholly new water contracts and diverse industry, that the question of how to monitor and regulate the quantities of water being appropriated by individual factories would become a central question. Water users could begin to measure their rights in cubic feet per second at a given head only after reaching an agreement that outlined a reliable method of taking such measurements and developing the machinery to measure water directly.[58] By contrast, most mills in the Connecticut River Valley operated under agreements where such measurements would have no force even if the technology to make such measurements had existed.

These barriers to development reflected the ongoing importance of historical rights to water, even if the nature of historical evidence shifted from ancient customs affirmed by the town's oldest inhabitant to contractual clauses establishing relationships between water privileges. Historical thinking guided the distribution of water. The difference between custom and contract concerned how people thought about history, not whether they thought about history. At the same time, they reveal that the explicit negotiation of water rights between mill owners tended to take vaguely defined spatial relationships in the use of water and reduce them to specific statements about access to water in a particular place. In this sense, contractual

58 Robert Barrett, *The History of the Holyoke Water Power Company* (Holyoke: Holyoke Water Power Company, 1989) 103; R.H. Thurston, "The Systematic Testing of Turbine Water Wheels in the United States" *Transactions of the American Society of Mechanical Engineers* 8 (1887):359-414; Clemens Herschel, *The Venturi Water Meter* (Providence, RI: Builders Iron Foundry, 1895)

readings of water rights made the history of water power distribution in specific places an important force in the maintenance of water power as a particular feature of specific factories rather than an abstract and fungible commodity.

The historical understanding of development in particular places served as an obstacle to the reproduction of water power on the grand scale as it had been modeled by towns such as Lowell. As such, it was a telling fact about Lowell that the historiography of the acquisition of its water power has always emphasized the shroud of subterfuge that went into acquiring the property in the first place.[59] Mill owners, even comparatively inefficient ones, preferred to hold onto their existing mill rather than selling to a larger factory. This meant that the ancient rights that lined the Connecticut and its tributaries would continue on well into the period of integrated factory development with quantified water. The development of Holyoke, as we will see in the next chapter, was the exception that proved the rule. It was also a pioneer in many of the quantitative practices that were so notably absent in this chapter because of its support for a variety of water powered industries in a single factory town. At the same time, the charter of the Hadley Falls Company at Holyoke—influenced by the legacy of legal conflict described in chapter three—would keep its dam operating as a function of the reach of river that it occupied, rather than the watershed at large. These experiences illustrate why the water rights held by small manufacturers did not evaporate so as to accommodate the grand vision of developing a factory town. The difficulty of separating water power from the obligations associated with particular contracts grounded in the design of mills for productivity at specific fall lines served as an obstacle for the larger scale development of water power along the Connecticut River. Between

59 Patrick M. Malone, *water power in Lowell: Engineering and Industry in Nineteenth-Century America* (Baltimore: Johns Hopkins University Press, 2009) 21-25.

1818 and 1864, the difference between community understandings of ancient rights and the narrow readings of contracts encouraged by the state became increasingly clear. At the same time, the difficulties of interpreting a water use contract as a flexible promise of space limited modifications to water power and the growth of factories dependent on that power. But this did not make the clearing of water rights and wholesale redevelopment of a factory site impossible. The next chapter will consider the course of events that would prove necessary for one such transformation at South Hadley Falls.

As something of a coda to this discussion of small water power, it is worth noting that the absence of a watershed perspective did not necessarily create radical differences in the networks of flow in the Connecticut and Merrimack watersheds when we look at those streams in the long term. The differences in the physical infrastructure of industrialization and its role in shaping the flow of the river, the differences between the Connecticut Valley and the Merrimack Valley were most pronounced between 1820 and 1865. They seem to have evened out to some degree between 1865 and 1880. As Theodore Steinberg noted in his conclusion, the central management of water along the Merrimack declined after the Civil War, and the intensification of the dam network on the Connecticut might have evened out flows just as effectively as central management. Nevertheless, the route that factory owners took to the coordination of management differed dramatically. In place of a single overarching corporation running the watershed, we find swarms of small mill owners, operating independently and using an array of contracts to coordinate their water use with mills up and down stream. Indeed, while it might seem that the location of a mill along an isolated fall line that minimized competition for water provided the optimal means of maximizing power availability, many factory owners preferred well developed streams. Considering the sparse development along the Deerfield River, a Connecticut tributary in Massachusetts and Vermont, civil engineer Dwight Porter observed that:

> "The present rather fluctuating wild and unrestrained character of the river may have much to do in deterring manufacturers from improving it so long as they can find other streams that are free from this disadvantage. The Deerfield is undoubtedly a violent river in freshets and is visited by heavy runs of ice but these are faults common to a great many New England streams in their natural state; they call for strongly-constructed works but become much modified as the streams are built up with dams, and as storage reservoirs are developed to distribute through the dry season the melting snows and heavy rains of spring."[60]

The mills located along the Connecticut River's tributaries might have coveted the heights of fall lines and lack of rival water users in more rugged terrain, but the advantages of working along established landscapes proved more enticing. Even if their mills were not financially or infrastructurally intertwined, their common operation on a single river simplified the problem of managing the flow of water.

60 Dwight Porter "Report on the Water Power in the Region Tributary to Long Island Sound" in William Trowbridge, ed. *Water Power in the United States* Tenth U.S. Census v. 16 (Washington: Government Printing Office, 1883) p. 106

Chapter Five:
New Channel, New Dam, New City:
Decoupling the Flow of Water in the Hadley/Northampton Meadows From the South Hadley Falls, 1831-1870

When Thomas Cole painted the *View from Mount Holyoke, Northampton After a Thunderstorm* in 1836, he could not have anticipated the storms—both literal and metaphorical—that would remake the river and the valley over the next decade. This painting depicted a storm blowing off the wild and uncultivated peak of Mount Holyoke while the sun shone on the Oxbow bend in the Connecticut River Valley below. Cole depicted the meadows lining the Connecticut River in Hadley and Northampton just four years before the river jumped its banks in a flood. More than a momentary restructuring of the landscape, this geological event touched off a series of changes in land and water management practices between the South Hadley Falls and the Northampton Meadows that would simultaneously intensify the industrialization and urbanization of the valley while also focusing attention on its pastoral heritage as an object completely separated from the process of industrialization. These changes represented part of a broader social fragmentation of the Connecticut Valley landscape that redefined how people viewed the flow of water as it shaped the floodplain. The seasonal, geological, and historical temporalities that had defined everyday life on the floodplain began to give way in the face of industrial development.[1]

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1 E. P. Thompson, "Time, Work-Discipline, and Industrial Capitalism," *Past & Present*, no. 38 (December 1, 1967): 56–97; Louis Legrand Noble, *The Life and Works of Thomas Cole* (Cambridge: Harvard University Press, 1964); Thomas Cole, *View from Mount Holyoke, Northampton After a Thunderstorm*, 1836, oil on canvas, item 08.228, Metropolitan Museum of Art, New York.

Figure 4: Thomas Cole, View from Mount Holyoke, Northampton, Massachusetts, after a Thunderstorm—The Oxbow, 1836, oil on canvas, 51.5" x 76", Metropolitan Museum of Art, metmuseum.org/art/collection/search/10497?=&imgno=0&tabname=object-information

From the discussion of the lawsuits surrounding the canal at South Hadley Falls in the third chapter ("The Business of Canalling"), we know that the water flowing through the meadows of Hadley, Easthampton, and Northampton on its way over the falls constituted one deeply intertwined hydrological space. The first canal dam at the falls regularly flooded upstream meadows, interrupted fisheries, was thought to exacerbate epidemic disease, and in the minds of some complainants actually prevented the navigation of the river. During the 1830s and 1840s a series of events separated rural life upstream from industrial growth at the falls. This initially symbolic disconnect became a real point of division that transformed the character of work and land use in the Connecticut Valley. Moreover, this transition occurred during a chaotic decade marked as much by accidents of fortune as by calculations of industrialists and town boosters. The river carved a new channel during a flood while fire leveled factories that had exercised ancient rights to water management. Only amidst the wreckage of these events did new investors sweep into town and redefine the landscape as a site for a railroad and a factory town.

The transformation of the upstream meadows by flood and the downstream factories by fire created something close to a wholly new opportunity for industrial development. As the fourth chapter reminds us, virtually every fall line in the Connecticut Valley had some historical claim upon its water power, so the flood that reconfigured the river and the fire that made all of the existing water rights from the South Hadley Falls available created a momentous opportunity for development. To take advantage of this water power, the Hadley Falls Company, and its successor the Holyoke Water Power Company, drew up new strategies for water management that evinced a conscious transition from the sale of water rights as an element of real property to a new industrial mindset involving the quantification and commodification of water itself. The Proprietors of Locks and Canals retired from the business of canalling, and the formerly flood-tolerant farming practices on Hadley's meadows gave way to concerns about bank erosion and the beginnings of flood control. Thus, responses by corporations and towns to the landscape transformations in the Connecticut Valley during the 1840s gave rise to the social changes that would encourage a turn toward thinking like a reservoir. It would, however, take until the 1870s for businesses to begin metering water in any effective way. The events of the 1840s marked a significant transition, however, because the promise of quantified water preceded the development of effective water metering technology that could deliver on this promise.

This chapter examines the combination of new water power technologies and investment opportunities that made it possible to transform the scattered enterprises situated at South Hadley Falls into the substantial industrial town of Holyoke. The charter for the Hadley Falls Company and their contracts granting water to manufacturers contained clauses that indicate how much the new water power company learned from the canal company's difficulties.[2] This continuity with the past disappeared in many historical accounts of Holyoke, which argued that the Hadley Falls simply evinced natural advantages for industrial development.[3] Such accounts neglected the fact that speculators and developers needed to find a means of bypassing, renegotiating, or buying out an array of existing land and water uses in order to establish a site for water resource development. Even with the transformation of the landscape by the river's changing course and the railroad's reengineering of its banks, the Hadley Falls Company sought to concentrate available water rights without interfering with land uses in the thriving agricultural communities upstream. The rebuilding of the dam at Holyoke in 1848 entailed the negotiation of limitations and regulations in how the town could transform the geomorphology and seasonal flows of the river.

2*Commonwealth V. Cooley* 3 Hampshire County Supreme Judicial Court Records (1819) 190, Cab. 9 (1) A14, University of Massachusetts Special Collections (Umass); *Commonwealth v. Enoch Chapin* 22 Mass. (1827) 199.

3Constance McLaughlin Green, *Holyoke Massachusetts: A Case History of the Industrial Revolution in America*, (New Haven: Yale University Press, 1939); John Cumbler, *Reasonable Use: The People, the Environment, and the State, New England, 1790-1930* (Oxford: Oxford University Press, 2001); Richard Judd, *Second Nature: An Environmental History of New England* (Amherst: University of Massachusetts Press, 2014)

Instead of approaching the South Hadley Falls as a blank slate for development or taking it over by enforcing a novel legal regime that could enshrine their corporate water rights, the investors bankrolling the construction of a dam and power canal at Holyoke built their new city in the space emerging from a series of accidents that opened the landscape up for industrial development and made it possible to envision a new industrial order in the valley. This points to a larger issue at stake in the industrialization of the Connecticut River Valley. The city of Holyoke, which regularly rolls off the tongue of historians describing the increasing scale of industrial production in New England, reflected an incremental rather than a revolutionary effort at adapting industrial practices in the commodification of water as a power source. The company initially sought to reproduce a successful practices from the Merrimack Valley, but these did not always translate to the context of manufacturing in the Connecticut.[4] Indeed, Holyoke failed as a textile town reproducing the patterns of factory management at Lowell, but it succeeded in finding novel ways of accommodating diverse industries, measuring water's flow, and commodifying water power. The legacy of small scale manufacturing, with its local and historically based orientation when distributing water, lived on even as the scale of production grew.

Too often, the history of Holyoke, Massachusetts, has been told as the ingenious—but environmentally limited—innovation of its initial investors. In this account, industrialists organized a railroad to run through the center of town even before anyone drew the first

4 Louis C. Hunter, *Water Power in the Age of the Steam Engine,* A History of Industrial Power in the United States v. 1, 1780-1930 (Charlottesville: University Press of Virginia, 1979); Alfred D. Chandler, *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, Mass: Harvard University Press, 1977); Richard W. Judd, *Second Nature: An Environmental History of New England* (Amherst: University of Massachusetts Press, 2014).

blueprints for a dam. These accounts treat industrial development on the Connecticut at South Hadley Falls as a natural and logical next step for the Boston Associates—a loosely affiliated gang of capitalists who played a central role in financing industrial development in New England.[5] By emphasizing the role of the finance capital from Boston in the establishment of Holyoke, historians tend to minimize or ritualize the work that went into adjusting the existing order of land use between Northampton and South Hadley Falls and the competing ways of knowing, owning, and working with water that existed in this region. At the same time, it ignores the course of events that left the Boston Associates investment in Holyoke bankrupt and on the auction block just eleven years after they built their dam.[6] Developers from Boston brought capital to the Connecticut Valley to build a new city, but they lost control over that city relatively quickly and in place of their vision of a city devoted to textiles, the actual industrial city that arose along the Connecticut became a center of paper production--a process with different power requirements and patterns of water use than textile mills. The industrial order—and its environmental consequences—would be quite different at Holyoke.

The varieties of industrial water use already at South Hadley Falls played an important role in shaping industrialization in that region. Technologies for distributing, measuring, and using water power changed dramatically in the first three decades of Holyoke's history—a process partially driven by the unique challenges presented by the variety of industries working in the town. While textile mills consumed water during working hours to power machines, paper

5 Cumbler, *Reasonable Use* p. 41-6; Francois Weil, "Capitalism and Industrialization in New England, 1815-1845," *The Journal of American History* 84, no. 4 (March 1998): 1334–54; Green, *Holyoke Massachusetts*; Thelma Maddie Kistler, *The Rise of Railroads in the Connecticut River Valley*, Smith College Studies in History, v. 23 (Northampton, Mass: Smith College, 1938).

6 Green, *Holyoke, Massachusetts* p. 19

mills also consumed water when processing fibers, running machines, and as a component of paper making itself, creating competing priorities for water management in any mill complex that managed both paper and textiles.[7] Water power was not a settled technology operating in the background of its mills. Instead, questions about the rate of water's flow through the canals and factories at Holyoke and South Hadley Falls played a crucial role in organizing the work of the city. While upstream landowners used legal protests and petitions to set an upper limit on the amount of water that would be available at Holyoke, factory engineers debated the optimal patterns in the flow of water through their flumes. Thus, far from being an inevitable result of opportunities for industrial development, the central questions about water use in the growth of Holyoke revolved around how exactly the water power company came to control the flow of water over the falls in 1846 and how they worked to transform that water from an element of real property embedded in riparian land into a fungible and tradable commodity over the following 30 years. In this sense, the conditions necessary to create Holyoke's water power canals represented the beginning of a transition away from the management of water through publicly understood forms of historical thinking such as those described in the previous chapter. The dam and its initial array of mills sat on the foundation left by the South Hadley Canal, and only as the water power company came to understand the particular needs of their customers would they begin building a successful industrial city that transformed the measurement and distribution of water.

The Connecticut River at South Hadley Falls provided an opportune physical space for water power development. Its basin is three times the size of the Merrimack River above Lowell,

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7 Judith A. McGaw, *Most Wonderful Machine: Mechanization and Social Change in Berkshire Paper Making, 1801-1885* (Princeton, N.J: Princeton University Press, 1987).

promising a more consistent pattern of water availability. At South Hadley Falls itself, it possessed twice the height of Lowell’s Pawtucket Falls, and thus it promised twice the available horsepower for exploitation. As a historical space, however, use of the falls was entangled with competing water power claims and years of litigation over dam building. This meant that existing water power use was by no means commensurate with its potential. It reflected a history of conflict over water resources dating back to the 1830s when the first conflicts over water power at South Hadley Falls resulted in litigation. The city of Holyoke's water power company depended on a complex web of water rights at the falls, but the company needed to acquire control over this web while also inventing machines that could effectively measure and shape the flow of water through its canals.

In order to accommodate an account of the river’s transformation at its banks and acknowledge its transformation from a broader—more panoramic—perspective, this chapter tacks between the view of the valley at large and the discrete changes occurring along the river’s banks at specific sites along its course. The first section traces the legacy of the view depicted in Thomas Cole’s *Oxbow* as a metonym for the narrative of modernization that insists on the separation of pastoral and urban narratives.[8] With this critical perspective in hand, it examines the string of accidents at locations upstream and downstream that helped to create the new hydrological landscape that accommodated commodified water. These accidents cleared away many of the particular uses of water that utilized a historically grounded understanding of the landscape. Having identified these specific events, it turns back to the debates over the

8 In this context, heritage follows the usage of Pierre Nora, “Between Memory and History: Les Lieux de Mémoire,” *Representations*, no. 26 (April 1989): 7–24; David Lowenthal, *The Past Is a Foreign Country* (Cambridge: Cambridge University Press, 1985); Francois Hartog, *Regimes of Historicity* (New York: Columbia University Press, 2014) p. 143-55.

construction of a railroad between Springfield and Northampton, a development long thought of as a spur to the industrialization of South Hadley Falls. This context makes it possible to explain how the ancient rights that governed water use became contractual promises to deliver baseline amounts of water and measured surpluses when available. At the same time, it helps to situate the larger changes in water management amongst which towns upstream from the factories of Holyoke began to build levees to wall out the seasonal floods that had formerly set the pace for time's passage across the landscape. These structures interrupted the processes of erosion and sedimentation that guided geomorphological change over geological timescales and this made the deep history of the riverine landscape within the floodplain increasingly difficult for casual observers to read.

Interpreting *The Oxbow* and the Creation of Hockanum Island

We typically think of the *View from Mount Holyoke During an Approaching Storm*, better known as *The Oxbow*, as a landscape painting, but in some respects it is best understood as a commentary on the place of the United States in history. When Thomas Cole painted it in 1836, Mount Holyoke was already famous enough to be called the second most popular tourist attraction behind Niagara Falls.[9] The view, featuring an array of cultivated fields surrounding an oxbow bend in the Connecticut River, had long been a popular vista for travel writers. By the time Timothy Dwight Mount Holyoke in 1796, he found that "on the highest part of the summit, the inhabitants have cleared away the trees and shrubs so as to open the prospect in the most

9 Alan Wallach, "Making a Picture of the View from Mount Holyoke," in *American Iconology: New Approaches to Nineteenth-Century Art and Literature*, ed. David C. Miller (New Haven: Yale University Press, 1993), 81–91.

advantageous manner."[10] It is interesting then that notwithstanding the popularity of Mount Holyoke as a destination and the claims that Dwight made about the civilized character of its summit that Cole's *Oxbow* depicted it as part of a wilderness at the boundaries of a civilized valley. Thus, the *Oxbow* took a long-settled landscape and transformed it into a parable about the contrast between the civilized and the wild, an approach that told a historical story even if it did not include the events normally prominent in more straightforwardly historical paintings.[11] Cole's work used a well-known scene to mythologize the drama behind the transformation of the landscape from a wilderness to a cultivated landscape rather than creating a photorealistic representation of its appearance. This form of mythologization would come to overshadow the real history of the Connecticut River Valley.

Cole's landscape paintings, like many of those of the Hudson River School, sought to imbue the wildness of the United States with a historical grandeur that could rival the deeper human histories of European nations without acknowledging the place or rights of indigenous peoples in these landscapes. Putting the natural world on a par with the bygone civilizations of the Old World evoked the story of how Americans subdued the wilderness in the context of a broader narrative about historical progression that Cole adopted across his body of work. When Cole painted the view from Mount Holyoke, he repurposed a canvas that he had originally stretched to paint *The Course of Empire: Destruction*—the fourth in a five painting series

10 Dwight, *Travels In New England and New York* (Cambridge, Mass.: Harvard University Press, 1969) I:257

11 Thomas Cole to Asher Durand, 4 January 1838 in Thomas Cole and Louis Noble, *The Course of Empire, Voyage of Life, and Other Pictures of Thomas Cole* (New York: Cornish and Lamport, 1853) 249; William Cronon, "The Trouble with Wilderness: Or, Getting Back to the Wrong Nature," *Environmental History* 1, no. 1 (January 1, 1996): 7–28; William Cronon, "Kennecott Journey: Paths Out of Town" in Cronon, George A Miles, and Jay Gitlin, eds., *Under an Open Sky: Rethinking America's Western Past*, (New York: W.W. Norton, 1992).

depicting the cyclical transformation of an Arcadian bay into an imperial capital, and its ultimate destruction and desolation. *The Oxbow's* canvas, which was initially intended to represent an empire's downfall, ended up depicting what was, on the surface, a realistic pastoral landscape.[12] Cole included portents of a flood in his landscape by shaping the deforested hill slopes on the far side of the valley in the Hebrew characters for Noah. This likely carried a broader social message about the threat of destruction than the connections between deforestation and erosion common during that time.[13] Even if he understood the broader connection between deforestation and erosion, he could not have anticipated the dramatic and immediate changes that a flood could make upon the landscape. Four years after he completed the painting, a torrential February flood dismantled the Northampton-Hadley Bridge and the debris from this structure formed a dam that redirected the river and wiped the oxbow bend central to Cole's view of the river off of the landscape.[14]

Cole's vision of history marching through progressive and inexorable stages of rise and decline parallels the standard historical account of water power development at Holyoke. Some historians have argued that the potential for this site as a center of water power was impossible to miss, that it was as inevitable as the rise of empires in one of Cole's paintings. This chapter rejects this narrative of inevitability, and it also looks critically at how Cole's painting represented the landscape. In the rejection of a narrative emphasizing the inevitable

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12 Cole and Noble, *The Course of Empire*; Lowenthal, *The Past is a Foreign Country* 114-6.

13 George Perkins Marsh, "Address Before the Agricultural Society of Rutland County (1847)" in Edwin C. Hagenstein, Sara M. Gregg, and Brian Donahue, eds., *American Georgics: Writings on Farming, Culture, and the Land* (New Haven: Yale University Press, 2011) 71-81.

14 "Freshet: Northampton Bridge Gone" *Hartford Courant* 27 February 1840; "The Connecticut River" *Yankee Farmer and New England Cultivator* 7 no. 31 (June 1841):241.

modernization of manufacturing on the river at South Hadley Falls, this chapter seeks to recreate how people understood the fluvial landscape during the 1840s and 1850s. To this end, it bears pointing out that images of the Oxbow were often identified with Cole's painting, but that this painting was not the image that made the view from Mount Holyoke famous. Cole sold his painting to a private collector and it was displayed only twice during the nineteenth century. It would acquire familiarity only after its donation to the Metropolitan Museum of Art in 1905 and its subsequent lionization in histories of American landscape painting.[15] Rather than Cole's depiction of the Oxbow, most Americans familiar with the view from Mount Holyoke—a view that loomed large in the pantheon of American landscapes—knew it through lithographs produced by William Bartlett and Basil Hall, two British illustrators who produced famous etchings of the Connecticut Valley during the 1830s.[16] These images focused in on the Oxbow as one element in the panoramic landscape visible from atop Mount Holyoke. The landscape portrayed in these lithographs had not yet taken on evidence of industrialization, and it still consisted largely of the neatly kept fields and spires that Timothy Dwight saw from the summit in 1796.

Hall's panoramic view relied on the new technology of the camera lucida to trace the view from atop Mount Holyoke. Until that time, the conventions of landscape painting tended to focus on the depiction of mountaintops from level ground rather depicting the view from a mountaintop. The overwhelming range of landscape visible from a mountaintop provided a

15 "National Academy of Design, Eleventh Annual Exhibition, "The Knickerbocker; Or New York Monthly Magazine 8, no. 1 (July, 1836): 115.

16 William Bartlett *American Scenery: or Land, Lake, and River: Illustrations of Transatlantic Nature* (London: George Virtue, 1840); Basil Hall, *Forty Etchings: From Sketches Made With the Camera Lucida, in North America, in 1827 and 1828* (Edinburgh: Cadell, 1829).

wealth of detail without a singular focus, an experience similar to the panoramic sublime, where viewers of images that exceeded their range of vision recognized the limitations of their own perspective even as the panorama itself promised an opportunity to take in the fullness of a scene. This marriage of landscape and technology opened up landscape painting to prospects that overwhelmed the human field of vision and sought to take in a whole landscape. Arguably, the arrangement of the landscape in an image that overwhelmed the field of vision had one unintended consequence. Taking in the fullness of the landscape encouraged viewers to seek out simplifying assumptions in assessing the landscape. Simplifying the landscape facilitated the assumption that the rural landscape visible from Mount Holyoke existed independent of the industrial landscapes surrounding it. This contributed to an understanding of the valley where observers ignored the connections between industrialization and the rural landscape. In one landscape, human interventions in river engineering fostered control over nature, while in the other water's flow overwhelmed ideas about controlling nature.

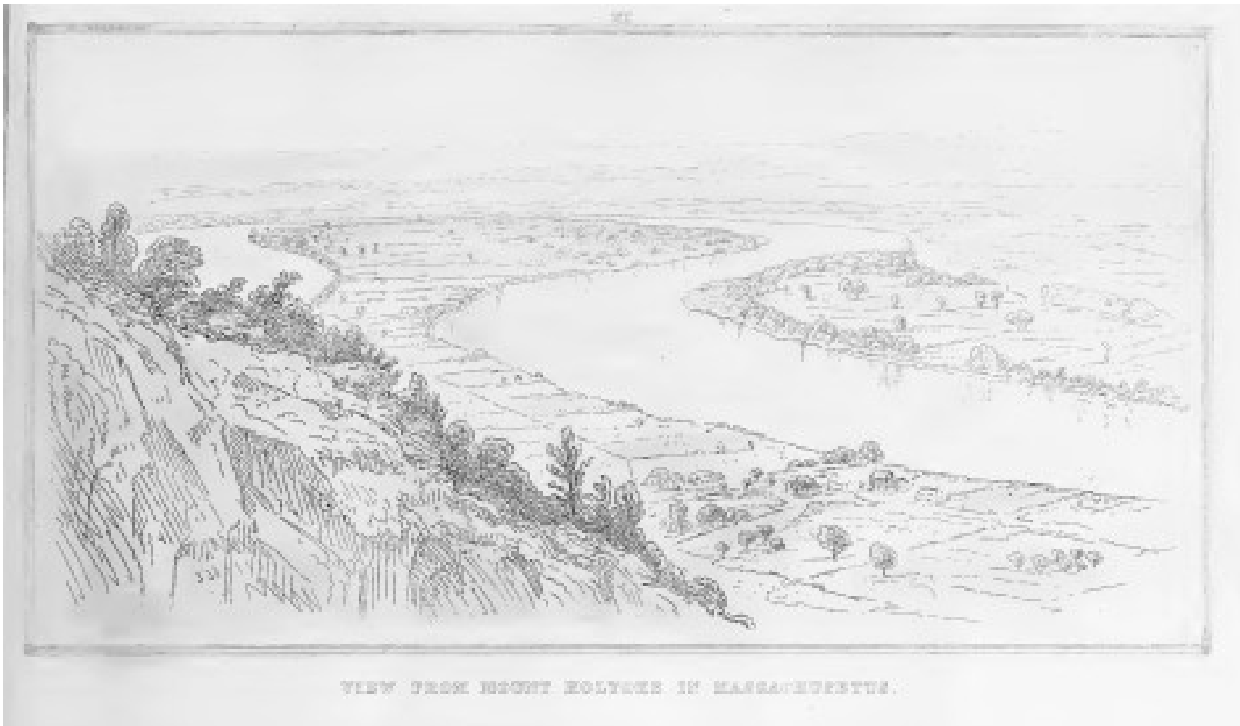

Figure 5: Basil Hall, *View From Mount Holyoke, Forty Etchings From Sketches Made With the Camera Lucida in North America in 1827 and 1828* (Edinburgh: Cadell, 1829) Plate XI, Scanned for archive.org by the Thomas Fischer Canadiana Collection, University of Toronto.

Hall and Cole could not represent the whole view from Mount Holyoke in a single image. This image ran a semi-circle, one hundred and eighty degrees ranging from Hadley's Main Street to the north, past the smokestacks and spires of Northampton in the northwest, around the sinuous curves of the Oxbow turn at Hockanum to the southwest, and finally resting on Mount Tom to the south and across the river from Mount Holyoke. William Bartlett elected to depict this visual range in a pair of lithographs, where the Connecticut River's bend took on an iconic significance, particularly as the views south and southwest proved eminently more popular as reproductions both in the printed works that Bartlett illustrated and in subsequent paintings and magazine articles highlighting the view. This is not to say that Cole was completely overshadowed, indeed by the 1850s his name had become a byword for panoramic views of the Oxbow, albeit through the distribution of Bartlett and Hall's illustrations under his name. Capturing this elision, a correspondent to *Harper's* said "the painter Cole has left us a bold chronicle of the wayward humors of the waters here. A hint at their odd caprices will be found in our odd budget of pencilings."[17] The attachment of Cole's name to the image overshadowed Bartlett's depiction, which actually provided the model for the copy in *Harper's* and an array of depictions ranging from Edward Hitchcock's *Final Report on the Geology of Massachusetts* to paintings by Victor De Grailly and Thomas Chambers.[18] What these images shared—and the *Harper's* article perpetuated—was a sense that the Oxbow remained a bucolic scene untouched by industry even as railroads and factories encroached on an increasing portion of the Connecticut River landscape. This contributed to a broader swath of the population thinking about the landscape as an image to be read panoramically rather than a physical place of work.

17 T. Addison Richards, "The Valley of the Connecticut" *Harper's New Monthly Magazine* 13 no. 75 (August 1856): 289.

18 "Depicting Mount Holyoke: A Dialogue with the Past" in Marianne Doezema ed. *Changing Prospects: The View from Mount Holyoke* (Ithaca: Cornell University Press, 2002) p. 31-36.

Figure 6: William Bartlett, *View from Mount Holyoke* in N. P. Willis, *American Scenery, or Land Lake and River: Illustrations of Transatlantic Nature* (London: George Virtue, 1840) Opposite p. 10, digitized for archive.org by the Getty Research Institute.

Early Proposals to cut off the Oxbow

Citizens of the Connecticut Valley had considered altering the course of the river at the Oxbow, or Hockanum Bend, since the 1820s. They debated, however, whether or not it would be prudent to change the river's course by plowing a new channel. They investigated whether reengineering of the flow of water by bridges and other infrastructure might change its course eventually. But during a February, 1840 freshet, the river actually changed its course. Precipitation upstream from Northampton raised the water on the river while cold and dry weather downstream kept the ice intact on the Connecticut River even as the level of the stream reached the height of ten feet. This confluence of events lifted the ice cover on the stream above the stone piers of the Northampton Bridge, overwhelming the ice-breakers designed to prevent ice from jamming beneath the piers of the bridge. When the ice broke on 26 February 1840, its blocks dislodged a span from atop one of its piers and carried it downstream. In the hours following, more ice and a span of the bridge from upstream in the town of Sunderland combined to remove a second span from the bridge. The river deposited the ice and timber running downstream in the floodwaters along the shoaled riverbed along the oxbow bend, eventually damming the course of the oxbow and redirecting the river to wash away the narrow band of alluvial soil at the neck of the peninsula. Most observers immediately recognized that this cut, approximately three and a half miles from the river's course, would be permanent.[19]

The elimination of the oxbow represented the natural culmination of a vision for reengineering the river that dated back decades. Boatmen from Northampton and upstream had first petitioned to cut a channel through the Oxbow Peninsula in 1821. The contrast between the vision that these would-be river engineers brought to the prospect of changing the stream and the actual results of its changing course are dramatic and telling. The petitioners envisioned significant improvements to shipping with the transformation of the river's bed. In their opinion: "with but little labor a dike may be cut upon the Hadley Side across the neck of the Peninsula which the river here forms, which by the by the operation and agency of high water would, it is apprehended, conduct the river into the same channel whereby the boat navigation would be

19 "Freshet: Northampton Bridge Gone" *Hartford Courant* 27 February 1840; "Editorial Correspondence: Northampton, Mass. February 28, 1840" *Hartford Courant* 2 March 1840; "The Connecticut River" *Yankee Farmer and New England Cultivator* 7 no. 31 (June 1841): 245.

facilitated. The present bed of the river rescued and rendered convertible into land for cultivation and public travel."[20] Notwithstanding these virtues, the residents of Hadley objected that there was a baseline of moral fairness in the natural transformation of the riverbanks, and that the village of Hockanum would lose everything while the continuing flow of the Mill and Manhan Rivers would make it impossible to reclaim this land. In the visions of the Northampton petitioners, living across the river from the Oxbow, the redirection of the river would create some 480 acres of farmland on the exposed riverbed while sacrificing a small tract and cutting more than two hundred and twenty acres of land off from the Hadley side of the river. In the visions of Hadley residents, this new land would all be swampy morass unfit for cultivation and unable to make good the losses of the communities living along the shore.

The petitioners from 1821 had also claimed that the elimination of the Hockanum Bend would create an improved climate for navigation.[21] It would shorten the river by four miles, cutting an hour's travel through a shallow and difficult-to-navigate reach of the river. Through this reach, boats would necessarily sail both east and west, necessitating some time sailing into headwinds regardless of the direction of travel. This was no small problem for shippers, and testimony from the petitioners indicated that boats could find themselves stranded for days waiting until lower winds could make the currents running through the Hockanum Bend navigable. Shipping, the overwhelming majority of which depended on wind, ox-drawn towlines, and ash poles powered by human strength, likely neared its peak in 1821, with more than twelve thousand tons of cargo passing through the canal at South Hadley in that year. This trade, mostly

20 "Petition of Joseph Lyman and Others to Change the Bed of Connecticut River" Senate Bill 6670 Doc. 1, 1821, Unpassed Legislation, Massachusetts State Archives, Boston.

21 Ibid.

consisted of forest products from the Upper Connecticut Valley—a byproduct of land clearance for the sheep boom sweeping the uplands—and commercial goods moving up from Long Island Sound and points south.[22]

The redirection of the river in 1840 did not fulfill the optimistic visions of Northampton residents. It stranded acres of choice farmland on an island, leading one reporter to speculate that the neatly cultivated fields of the oxbow—which measured approximately 290 acres—had lost almost half their value in the course of their detachment from the mainland of Hadley.[23] Where the land on the Hockanum Bend had been worth approximately $100.00 an acre, it was now worth fifty, and the island's values as a whole dropped from $29,000.00 to $14,500.00. If the estimates of the petitioners that the new channel would cut off two hundred and twenty acres of land was correct, that means that the redirection of the river eliminated $36,500.00 of value in the land. The incomplete drainage of the oxbow lake at the bend meant that there was no opportunity to reclaim that land, eliminating the potential gain of $48,000.00 in land value from the river's new course. The owners of Hockanum Meadow responded to the river's cleavage of their property by dividing into two bodies of proprietors. At the same time, the ferryboat at Hockanum took on a new importance as a means of connecting Hadley residents with their alluvial farmland. For boatmen, the 1840 redirection of the river provided benefits to navigation,

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22 Harold Fisher Wilson, *The Hill Country of Northern New England: Its Social and Economic History, 1790-1930* (New York: Columbia University Press, 1936); David R. Foster, "Land-Use History (1730-1990) and Vegetation Dynamics in Central New England, USA," *Journal of Ecology* 80, no. 4 (December 1, 1992): 753–71; Richard William Judd, *Common Lands, Common People: The Origins of Conservation in Northern New England* (Cambridge, Mass: Harvard University Press, 1997).

23 "Editorial Correspondence" *Hartford Courant* (2 March 1840): 2

but the business of navigation had not grown in the last decade.[24] Indeed, the inaction of boatmen and upstream farmers in the face of a dramatically changing landscape suggested that the Hockanum Peninsula had lost some of its centrality during the previous two decades.

Ending Ancient Rights at the Canal: *Josiah Bardwell v. David Ames et al.*

When last we addressed the operations of the South Hadley Canal, in 1827 Enoch Chapin had successfully defended the proprietors' right to operate their dam over the objections of upstream landowners.[25] This produced one of the most stable periods in the Canal's history, and also contributed to the expansion of the industry along the canal. During the 1830s, a local miller named Josiah Bardwell became the central figure in managing traffic through the canal and oversaw the expansion of manufacturing privileges along the canal.[26] His efforts at development hit a snag when competing spatial and place-based interpretations of his water sharing contracts became embroiled in litigation. This dispute lasted the whole of the 1830s, a period when revenues on the canal remained steady, as measured by receipts and dividends, but with no real growth.[27]

The primary site for water power along the Canal came from a wing dam downstream from the entrance. It jutted out into the channel of the river about two hundred and fifty yards

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24 "Act to Establish the Northampton and Springfield Railroad" Mass. Acts, 1842 ch. 41 p. 509.

25 *Commonwealth v. Enoch Chapin* 22 Mass. (1827) 199.

26 Untitled Document B-6,b 22 February 1830; Treasurer's Account, 1934, B-3,c L&C

27 "Treasurers' Reports" 1822-1832, B-3,a, Proprietors of Locks and Canals on Connecticut River Papers, Library of Congress; Treasurers' Report, 1834, B-3,c; David Culver and David Stockbridge to Proprietors of Locks and Canals, 20 March 1833, B-4,c describes the problems associated with navigating the canal.

where the Falls took their most dramatic drop and a string of five locks lowered barges downstream.[28] This dam, built in 1824 by Josiah Bardwell, funneled water into a flume that ran along the embankment separating the canal from the river. The wing dam provided water power among mill sites owned by: Enoch and Bathsheba Chapin, who were the heirs of Ariel Cooley; a partnership between Wells Lathrop, Charles Howard, David Willard and Eli Stephenson; and Bardwell himself. Bardwell received the riparian rights that attached to each of their properties in exchange for a portion of the water that pooled behind his dam. Responsibility for maintaining the dam, the millpond that it fed, and the flume that carried water to the mills fell evenly on each water user notwithstanding Bardwell's ownership of it. Each mill owner received a guarantee of their right to the water based upon the design of the sluiceways and headgates connecting the flume to individual mills. This transformed the historical rights to water owned by neighboring mills into a network of water rights defined by the placement of flumes relative to a common mill pond.[29]

In splitting up access to water, each of the users received a grant of rights proportional to the capacity of their sluiceways. The agreement promised water flowing through multiple gateways, each measured to the quarter of an inch and a head of power coming off of the dam measured to the nearest inch. Like many of the water rights described in the previous chapter, this agreement appears to have formalized the existing arrangement of water distribution and turned it into a comparative measure of water provided. It represented an incremental addition to the organization of industrial water rather than a transformation of its flow. In addition to these

28"Map of Connecticut River at Ireland Parish and Canal Village as Drawn from the Field Notes of Stewart S. Chase made in 1847," in Robert Barrett, *The Origins of the South Hadley Falls Company* (Holyoke, Mass.: Holyoke Water Power Company, 1985).

29 *Bardwell v. Ames* 39 Mass. (1839) 337.

rights, Bardwell reserved a great deal of water for himself as a potential source for power because he projected the construction of several more mills running downstream in the river. While this contract froze the existing dynamics of water use in time and space, it also froze the vision of expanding millpower at South Hadley Falls in line with how Bardwell imagined growth along the canal embankment. Thus, the contract between Bardwell, the Chapins, and Lathrop appeared to cover the future of water power along the canal.[30]

The future held a different course for the development of Bardwell's dam. By 1831 there had been no development below Howard and Lathrop's factory, but in the meantime, the Chapins had sold their interests to Howard and Lathrop, uniting the titles to water held by all of Bardwell's counterparties in their hands. Then, in 1831, Bardwell made a further sale of water rights to David Ames Jr. and Jonathan Ames, providing them with water rights equivalent to those of Howard and Lathrop, but situating their mill upstream at the head of the flume rather than downstream at its foot. This additional grant of water was not accompanied by the withdrawal of any water from existing contracts. The location of Ames' mill proved important because Bardwell sold them water rights equivalent to those exercised by Howard and Lathrop, but those mills stood in different physical relationships with the flume. The relative size of a water power is a function of the gate size, the length of the fall, and the velocity of the streamflow bearing down on the wheel. Reading the Ames contract as a description of flumes and gates would provide for a smaller amount of power relative to reading the contract as a description of how much power Ames' factory ought to have available. Differences in the space between the dam and the wheel on the flume meant that a contract promising the same amount of

30 Ibid.

water power actually might provide for a larger or smaller volume of water. On the other hand, the length of the fall and the size of the gates could be measured directly, but the velocity of streamflow remained an object of debate and inquiry during the mid-nineteenth century.[31]

Without a convenient means of converting the specific grants made between water users in highly specific contexts into an abstract quantity of water, it proved difficult to establish a fair means of granting a new mill privilege on an established stream. In Lowell, the proprietors had solved this problem by creating a new system of measure, a mill power, that provided sufficient flow to move 3,584 throstle spindles, a measure formulated for a town dominated by textile mills and which was variously estimated as consisting of between fifty and one hundred horsepower.[32] The amount of water used to power a spindle varied based upon the efficiency level of the intervening machinery, making the correspondence between water consumption and power production appear straightforward, but actually leaving it tenuous at best. Factors ranging from the settling of factory floors under the weight of machinery or minute imperfections in fabrication could throw off estimates of how water's flow turned into productive power.[33] This grew more complicated at South Hadley Falls where mills operated without a central machine shop managing the design of factories. While the Ames Mill and the Howard and Lathrop Mill produced paper, they relied on a water power that had been established for mills processing oil and sawing timber. The indenture divided water for this mixture of uses. To this end, it ensured that they divided the water by calculating the rough volume of the flume and subdividing the

31Clemens Herschel, *The Venturi Water Meter* (Providence: Builders Iron Foundry, 1894)

32"The Cotton Manufacture of the United States Compared with that of Great Britain" *Monthly Chronicle* 1 (October 1840):398; Green, *Holyoke*.

33 Steinberg, *Nature Incorporated* 79-95.

individual water powers to take in the water released by that flume. Like the mills chronicled in the previous chapter, Bardwell's mill distributed water through the physical distribution of access to water, not based upon physical volumes of water, but rather based upon an educated guess about water availability.

The total amount of water due under Bardwell's contract with Ames varied materially depending on whether it was understood as a promise to provide water or a promise to provide power. As we saw in the discussion of water-power measurement in Lowell, the amount of water used and the amount of power generated could vary dramatically within a single factory system. Bardwell and Ames could not begin to have a conversation about water power, however, without first agreeing on whether they had decided to measure it in terms of water flow or mechanical power. Bardwell thought he had sold the Ames family the right to build specific flumes of specific dimensions, but the Ameses believed that they had bought a specific amount of power. Ames calculated the amount of power available by reference to both variables of gate size and head, but Bardwell thought of this contract in terms of water rights attached to actual physical elements described in his indentures. The contract specified that in the event of a drought, the water would be distributed in proportion to the rights of individual water users, but it remained unclear how the users might have actually carried out such as division, and indeed the court case that arose from this contract noted that there had never been such a conflict. Thus, the parties to this agreement held water as property, but it remained functionally indivisible from the factories to which it was attached and the space in which it was used.[34]

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34 *Bardwell v. Ames* at 339

The Ames family assumed that the contract provided them with an equal volume of power to Howard and Lathrop's mill rather than merely an equal volume of water, and began building accordingly. Because their mill sat above Howard and Lathrop's mill on the embankment, they could not benefit from the same head of water that their downstream neighbors exploited. Thus, they constructed new flumes in the dam that provided water in excess of the dimensions that Bardwell had provided, calculating that this extra water would make up for the loss of head relative to Howard and Lathrop. Bardwell watched this development with apprehension and in 1832, he filed a suit against the Ameses because he believed that their contract should provide enough power for only six machines processing up to one hundred and twenty pounds of material, but the Ameses had installed twelve machines with a capacity for processing one hundred and fifty pounds of material. Outside of the shop, Ames built two separate flumes, one of which drew water from the spillway of Bardwell's wing dam and the other of which drew water from the flume as specified in the contract. Howard and Lathrop complained that Ames' mill would draw as much water as all of the other water users combined, and then it would flood the drainage tailrace running behind their mills to a height that would interfere with the rotation of their water wheels. Ames replied that Bardwell and Lathrop would only face problems with their raceways because they had restructured this element of their mills to restrict the flow of water back into the river.[35]

The effort at determining exactly how many cubic feet per minute the Ames contract provided for ran aground on the difficulty of calculating the exact amount of force with which the water pooled by the wing dam passed through the flume. The degree of confusion about the

35 Ibid. at 342.

measure of actual water power is revealed by the conflicting reports about the precise volume of water available at the wing dam. As Bardwell's complaint ran through the courts, it came first to a master of chancery, Charles Forbes, who concluded that under the original indenture Lathrop and Howard were entitled to 11,513 cubic feet per minute, Bardwell was entitled to 4,441 cubic feet per minute from the dam, and 8,776 cubic feet per minute from the stone flume—a total of 13,217 cubic feet per minute. Bardwell and Ames had perhaps erred in the calculations of water available, as Bardwell's 1832 complaint averred that the Ameses were entitled to 12,335 cubic feet of water per minute, but they had built works that could process 31,000 cubic feet per minute. Their clashing presentations of water availability indicated the difficulty of measuring water power in place, a problem that would become a central element of the water management process at Holyoke. In the meantime, the apparent impossibility of measuring water power in situ shaped Justice Lemuel Shaw's decision when the case finally reached the Massachusetts Supreme Judicial Court in 1839.[36]

Between the work of the special master in 1834 and the court's decision in 1839, Ames and Lathrop made a series of modifications to the flow of water through their mills. Ames sought to resolve the complaints described in the suit by building a flume running from a small spillway in the wing dam itself, which was designed to draw debris such as timber over the lip of the dam and safely onto the foot of the falls. It might have resolved the conflict if Bardwell had accepted it as a modification of the stream rather than a modification of the dam. Bardwell objected that this work threatened to throw water back on the face of the dam when not in operation and moreover, that drawing so much new water into the system would overwhelm the tailrace shared

36 Ibid. at 350.

by all of the mills. Ames countered that Bardwell's complaints arose only because Howard and Lathrop had enclosed the tailrace as it passed across their property and that formerly they had simply allowed water to run down their riverside banks into the stream, meaning that they had brought this increased risk of flooding upon themselves.[37]

To review the substance of the argument: in 1831 Ames had built a paper mill that Bardwell believed was poised to consume two and a half times the volume of water to which it was entitled by contract. Ames countered that Bardwell had actually sold him the rights to use this much water when his right was framed relative to the actual power that Howard and Lathrop consumed. At issue was whether the contract between Bardwell and Ames had accounted for Howard and Lathrop's mill benefiting from its lower point relative to the millpond. Ames had tried to settle this dispute by tapping a new water source—a waste gate in the wing dam itself—rather than the millpond and flume that had been described in the contract. The Master of Chancery investigated the rival claims and concluded that there was far less water power available in cubic feet per minute than either Bardwell or Ames had imagined was available for distribution. Thus, there were two pertinent questions at issue before Justice Shaw when determining the case. The first was how should water be measured at the wing dam? The second was who was entitled to what portions of this water?

Shaw's decision rejected all of the calculations grounded in the volume of flow. He could not comment on the facts presented by Forbes in his capacity as Master of Chancery, so the facts on the table before him only referenced Bardwell's belief that Ames had constructed a factory to process 31,000 cubic feet per minute of water while only owning the right to 12,335 cubic feet

37 Ibid. at 351.

per minute. He could not act to reconcile these numbers with the numbers generated in the chancery's investigation of the site even though these numbers plainly contradicted the statements of parties to the case. This threw Shaw's reading of the contract back onto the wording of the indenture specifying water rights based upon the design of openings accessing the flume rather than the calculation of power provided by that water.[38] The quantification of water remained a prospective goal of water power companies, even as historical accounts of water use continued to dominate the landscape. This decision dealt a legal victory to Bardwell, but his victory did not end the dispute. Shaw's decision threw Bardwell and the Ameses back into negotiations over how to redistribute the water at South Hadley Falls. Only through a mutually agreed upon program for water sharing would they be able to continue their work of manufacturing and expanding the productivity of the falls site.

Moreover, the 1839 legal decision indicated the difficulty of turning water at an already developed site into an abstracted and saleable commodity. The Supreme Judicial Court's decision indicated that it would be impossible to begin selling water as a function of the power it provided rather than a function of its appurtenances with readily recognizable rates such as cubic feet per minute without the mutual consent of all existing parties sharing water at the site. Consequently, only through negotiations with Ames would Bardwell be able to effectively limit Ames' water consumption and become able to sell the water rights reserved for the tracts downstream. Bardwell did not find himself bereft of power. He could seek damages from the Ameses for consuming water in excess of their grant, and require them to post bond against continuing to consume more water than their allowance. Additionally, Shaw agreed with the Master of

38 Ibid. at 357-366

Chancery who ruled against the Ameses for their maintenance of a flume drawing on the wastewater of the wing-dam specifically because they had built that flume at a spillway intended to protect the dam from debris, and this threatened the integrity of the dam. This left the Ames family without a simple solution to the problem of water power that did not involve the diminishment of their productive capacity. At the same time, the victory for Bardwell merely gave him an advantageous position for negotiating future water rights.[39]

Seven years of litigation proved more than adequate for Bardwell and Ames, and they negotiated a new agreement for water rights in 1841. At the center of this agreement was a commitment by the Ameses to replace the wing dam, incorporating their own penstocks into the design for this dam and bypassing the smaller millpond that still fed water to Howard and Lathrop's paper mill and Bardwell's sawmill. This agreement envisioned the construction of a new section of dam "on a line of the outer sill of the penstock down to twenty feet below the southeast corner of Ames' Mill."[40] In this fashion, Ames took responsibility for rebuilding the existing dam and the penstock that he had run from the wing dam directly to his mill while also rebuilding the dam itself and agreeing to develop a separate raceway that would drain the water drawn in by this new source. In essence, Bardwell took his legal victory over Ames and turned its settlement into an asset for the factory complex by having Ames take on a greater portion maintenance on their common dam. The work of maintaining the dam became a means of renegotiating the distribution of water flowing over the dam. The question of whether the users

39 "Agreement About Water Works and Renegotiation of Water Rights" 1841, X-5d, L&C; Bardwell v. Ames at 369.

40 "Agreement About Water Works."

of water knew the precise quantity of water that they consumed reverted to the background and the central focus became the accommodation of neighboring rightsholders.[41]

In order to live up to their promises to rebuild the wing dam, the Ames family took out a complicated network of mortgages that steered them into dire financial straits. These mortgages created a chain of note holders stretching from David Ames senior through the business community of the lower valley until they rested in the hands of the Proprietors of Locks and Canals, who tried to foreclose on 27 February 1845.[42] They need not have bothered. A fire on 8 May 1846 destroyed the mill and rather than rebuilding, the Ameses sold the land to the Proprietors, reunifying the land titles to the canal with the title to its banks and making it possible to contemplate its sale as part of a broader effort at restructuring the water rights in the vicinity of the falls. This proved an important precondition to the Hadley Falls Company's reorganization and their play at buying up the riparian titles on both banks of the river at South Hadley Falls. The legacy of *Bardwell v. Ames* lived on in the structure of water sharing agreements that would emerge in the development of the Hadley Falls Company.

The impossibility of measuring the flow of water and the problems created by conflicts over the distribution of water played a significant role in making water conflicts among factories at South Hadley Falls end in stalemates and compromise. This was a place where the industrial development could not be expanded because any transformation of the water distribution network would have required consensus among rival water users who possessed only provisional means of quantifying and sharing their water. Thus, the contractually defined ways of seeing water among small mills defined the flow of water in the valley far beyond their factory walls.

41 Ibid.

42 "Abstract of the Title of Ames Paper Mill" 1843 W-4, a, L&C

The potential for companies at South Hadley Falls to expand their water power network and foster the construction of new factories and the distribution of greater quantities of water – with all of its attendant impacts on the landscape of the valley more generally – depended on their ability to either move existing water users off the river, or renegotiate their contracts. *Bardwell v. Ames* illustrated some of the difficulties that attended this process.

Building a Railroad Through the Oxbow

After the river changed course, the dynamics of its flow past the village of Hockanum changed and the process of bank erosion accelerated. Three years after the river jumped its banks, as landowners from Hockanum had come to understand the process of erosion at work in the new channel, the Northampton and Springfield Railroad received its charter from the State Legislature for a route running through Hockanum Village. The railroad wanted a level embankment to facilitate the smooth laying of rails and the Town of Hadley wanted just such an embankment to protect the integrity of the riverbank in Hockanum Village. In this vision, articulated in Hadley, The railroad would double as a levee, and therefore even if it did not provide direct service from a station in the neighborhood, its presence would prove a boon to the village because the profits from running trains would subsidize the maintenance of stone revetments reinforcing the bank and contribute to the maintenance of the remaining farmland in the face of continuing erosion.

Thinking in these terms reframes our understanding of how railroads fostered social change. In addition to carrying materials and goods, they also contributed to re-engineering the flow of water even as they moved freight traffic off of the river and onto their tracks. In addition to their promises to spur economic growth, grow the population, and increase commercial activity, railroads reshaped the physical landscape where their berms, causeways, and piers transformed drainage and river flow. These transformations could destroy farmland and redirect rivers, but they could also create functional levees where the ballast and fill used to keep a railroad running on a level across uneven terrain reinforced the abutting riverbanks, preventing the formation of new channels. Alongside economic and social arguments, the landscape changes accompanying railroad construction shaped how communities responded to proposed routes during the nineteenth century.[43]

The clear majority of historical works analyzing railroad development argue that the narrow economic interests of investors superseded physical geography and directed their construction.[44] In this, historians share distinguished company, as George Perkins Marsh said "cases can be cited where engineers and directors of railroads, with long grades above one hundred foot to the mile, have regularly sworn in their annual reports, for years in succession, that there were no grades upon their routes exceeding half that elevation. In fact, every person conversant with the history of these enterprises knows that in their public statements falsehood is the rule, truth the exception."[45] This can be seen in the histories of the Northampton and Springfield Railroad that assume the routing of that road through the future site of Holyoke

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43 T. G. Carpenter, *The Environmental Impact of Railways* (New York: Wiley, 1994); Diana DiStefano *Encounters in Avalanche Country: A History of Survival in the Mountain West* (Seattle: University of Washington Press, 2013); Richard White, *Railroaded: The Transcontinentals and the Making of Modern America* (New York: W.W. Norton, 2012) p. 140-52.

44White, *Railroaded*; Stephen Salisbury, *The State, the Investor, and the Railroad* (Cambridge: Harvard University Press, 1967)

45 George Perkins Marsh, *The Earth as Transformed by Human Action* (New York: Scribners, 1874) 53.

indicated some vision on the part of the company that an industrial city would grow at that point. The majority of historians working during the twentieth century have assumed that the railroad followed rumors of the development of an industrial site at Ireland Parish, but these assertions rest on little archival evidence, often appearing as suggestions that the site was chosen "probably with a view to the development which was in fact to be effected two years later, the promoters changed the place in 1845 and the tracks were laid along the west side of the river down to the lower rapids and then across at Willimansett."[46] While it is undoubtedly true that railroads sought to maximize their economic benefits, it is important not to assume that every economic benefit they gained was foreseen by their projectors. Secondly, analyses of railroad promotion tend to treat the communities advocating for a particular route as unthinking boosters of their towns. This is certainly true in some cases, as North Hadley farmer Levi Stockbridge noted in his diary during the heart of the railroad routing controversy: "the railroad is making some excitement. Hurrah for our side."[47] But the benefits and potential for railroad development were by no means a foregone conclusion and communities actively debated how to avail themselves of the railroad's benefits. Not every town imagined itself a railroad hub and the Town of Hadley's experience illustrated another fashion in which railroads could transform everyday life.

Careful attention to discussions of what was and was not physically possible provided a means of understanding the environmental limitations that people imagined would govern the design of the Northampton and Springfield railroad. Much like the proposals for altering the

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46Constance McLaughlin Green, *Holyoke Massachusetts* p. 18; a similar sentiment appears in Thelma Maddie Kistler, *The Rise of Railroads in the Connecticut River Valley*, Smith College Studies in History, v. 23 (Northampton, Mass: Smith college, 1938); and Cumbler, *Reasonable Use.*

47 Levi Stockbridge, Diary, 31 July 1844, 10 February 1845, UMass.

channel of the river discussed above, arguments for and against railroad routes provide insight into how people imagined the landscape as a transformable space and what sacrifices they thought worthwhile in its management. While historians often dismiss these details in writing about railroad development because they look like so much window dressing around the real process of negotiating rivalries between businesses, their framing also provides a means of explaining the range of the plausible claims about how railroads could reshape the landscape. Railroads and the towns where they proposed to travel framed their objections and modifications to proposed routes in terms of geology and climate. They discussed how access to geological resources such as ballast and firm ground might affect the route's stability. They also argued over how different configurations of the road might affect the erosive power of the spring freshets. Thus, debates over railroad routes revealed the assumptions that both railroads and communities made about the character of the landscape and how these landscapes might respond to industrialization.

The first charter for the Northampton and Springfield Railroad passed the state legislature in 1842. It described a short line connecting a station in the vicinity of the county courthouse in Northampton with the tracks of either the Western Railroad or the Hartford and Springfield Railroad, both of which ran up to the factory town of Cabotville—which would later become Chicopee Falls.[48] This consisted of only thirteen miles of track along a route that virtually centered on the management of traffic past the Hockanum Bend, around Mount Holyoke and down past the South Hadley Falls. It is likely that the choice of an east side route reflected a desire to amass voters in the legislature to support the charter, as this route connected several

48 For the lay of the land see the 1895 USGS Topographical map attached to this chapter.

centers of population including the towns of Hadley and South Hadley, while a route on the west side of the river would run the train through thinly populated Ireland Parish. Moreover, the route along the Hadley Bank on the east side of the river between Hockanum and South Hadley Falls provided an opportunity to fix the problems of erosion created by the new channel at the Oxbow.

The reasons for debating the route lay in the contrast between the initial vision of the charter and the later vision of the railroad's projectors. The owners of the Northampton and Springfield road delayed building their road because they lacked funds. Meanwhile, the success of the Western Railroad—which ran from Boston to Albany—shifted the focus on railroad promoters from the development of local lines to through routes that could capture the traffic of branch lines.[49] As the residents of South Hadley would point out in their defense, the route through Hockanum connected important centers of population on both the east and west sides of the river and encouraged the growth of local traffic in existing communities.[50] During the interim between the passage of the charter and the construction of the road, philosophies of railroad building changed. Rather than prioritizing local traffic and maximizing accessibility in a local area of individual communities, the railroad began to be conceived of increasingly as a means of connecting regions and a point of competition between individual towns within the valley.

The meandering of the Northampton and Springfield Railroad through Hadley and South Hadley, might increase local traffic on the rails, but in a future dominated by visions of through routes and branch lines, this promised difficulties for the profitability of the railroad. Eager for railroad development, but wary of the monopoly power that any one railroad might exert, the

49 Kistler, *The Rise of Railroads*; Salisbury, *The State, The Investor, and the Railroad.*

50 "Remonstrance of the Residents of South Hadley," in "Authorizing the Northampton and Springfield Rail-Road Corporation to Change its Location" Mass. Acts ch. 190, Approved 21 March 1845, MSA.

state legislature proved willing to charter lines much faster than they could be built. Competition for funding depended on projections of future traffic, but charters for competing lines threatened to limit traffic. Moreover, railroads depended on cooperation in addition to competition. Charters included clauses allowing rival lines to connect with neighboring routes. For example, the Hampshire and Franklin received a charter to connect with the Northampton and Springfield at Hockanum Bend, cutting this line off from the Northampton and Springfield's terminal station located in the Northampton town center. Moreover, the Hampshire and Franklin Railroad, received a charter to run up the east bank of the river between Hockanum Village in Hadley up through Hadley Center and into Sunderland and Montague, where it would meet the Vermont and Massachusetts Railroad. It did not take much imagination to realize that the Hampshire and Franklin might capture the traffic running south out of Vermont and northern Massachusetts, making the Northampton and Springfield a mere side track to the main line running upriver from Hockanum Village, an outcome that would have crushed the value of the Northampton and Springfield Road relative to the Hampshire and Franklin.[51] Faced with this threat, the Northampton and Springfield petitioned for the charter of the Northampton and Greenfield Railroad, which would travel up the west bank of the Connecticut between the eponymous towns in its charter, cutting out the east bank towns entirely. To avoid any truck with the proposed Hampshire and Franklin road, the Northampton and Springfield began petitioning to move their road across the river, where it would pass below the foot of Mount Tom and through Ireland

51 “Act to Incorporate the Hampshire and Franklin Railroad Company” Mass Acts ch. 29 approved 1 February 1845; “Act to Incorporate the Greenfield and Northampton Rail-Road Corporation” Mass Acts. Ch. 8, approved 21 January 1845.

Parish, the future site of Holyoke, before crossing the river below the South Hadley Falls at the Willimansett Rapids.

In hearings on this subject, proponents of the Northampton and Springfield argued that the initial survey had been too hasty in choosing the east side of the river and that it had ignored the flood risk created by building a railroad bridge above the Hockanum Bend. The railroad interests touted the value of moving the river crossing downstream, noting that “the dam at South Hadley tends to fill up the bed of the river, and considering the slight fall of in the river for twenty miles above the dam we can see no reason why other obstructions in the current should not assist in producing such a result by checking its velocity and lessening its power to clear the channel.”[52] This argument emphasized the relative hydrological benefits of keeping the railroad from crossing the floodplain, despite the difficulties associated with the increasing distance between the centers of population on the river’s east side and the new route of the road.

Residents of Hadley, particularly the proprietors of the Hockanum Meadows, newly moved to the west side of the river by the 1840 flood, disagreed with this argument. Despite the concerns that the Northampton residents expressed about siltation, the residents of Hockanum noted that the west side route would “prove highly detrimental to the interests of the town by rendering far less productive the island of Hockanum, so called, rendering Hockanum Meadows less valuable by exposing it to the action of so rapid a current as will be produced by turning the whole body of the water of the Connecticut in high freshets through the gap recently made by the waters of said river and across said meadow.”[53] The construction of the railroad causeway would

52 “Northampton’s Memorial to the Legislature” reprinted in Hadley Town Meeting Records, 11 November 1844.

53 Hadley Town Meeting Minutes, 31 January 1845.

limit the flow of floodwaters into the Oxbow, but they thought of this problem as one that would not only affect Hockanum Island, but one that would erode the banks of the Connecticut River. On the east side, they admitted that “a bridge near Hockanum ferry might add to the exposure [to floodwaters], especially to the village of Hockanum and places immediately above would be very much increased.”[54] But residents of Hadley did not limit their sense of the railroad’s hydrological significance to the choice between the bridge and no bridge. Indeed, the Hadley Town Meeting resolved that a railroad bridge and a causeway across the Oxbow might create the same problems with flooding "on account of the hundreds of acres of low land being shut off from the river by the road; which during the freshet are usually overflowed and serve as a reservoir and a safety valve, and over some parts of which since the new channel was formed in 1840 ice has passed with such force as to turn over or break off trees a foot or more in diameter. Therefore, if the proposed road is built over the island through the former bed of the river, and the adjoining meadows, [and] therefore, if the proposed road is to be made firm enough to withstand the annual floods, it must force the ice water and floodwood into a narrow channel at a point where the river takes a new direction and thus has less power to carry off obstructions.”[55] The residents of Hadley objected to the rerouting of the railroad because they believed that the distinction between hardening the west side and running another bridge across the river above the falls would prove less significant than its promoters indicated.

Hadley residents had worried about the integrity of the riverbank since the river cut its new channel. There were ongoing debates in town meeting about reinforcing the riverbank.[56] Nevertheless, many in the town preferred to rely on the railroad to reinforce the riverbank or to

54 Ibid.

55 Ibid.

let the process of erosion follow its course. Thus, efforts at controlling erosion did not occur without some debate, as Levi Stockbridge described how he "attended town meeting that was called (and is the third that had been called for that purpose) to see if the town will raise money to protect the high banks from the encroachments of the river. After many motions for the raising of money that were lost, much hard feeling displayed, and personal and abusive language had been used by opposing parties, it was voted to…procure an engineer to secure the bank and report what would be the most feasible method to perform the work."[57] The turn to engineering at Hadley reflected a changing sense of what the natural course of the river might be. While the town had defended its changing channel as a fact of life during the 1820s, after the destruction of the peninsula in 1840 they began to worry about the integrity of the riverbanks. Moreover, they decided that intervening in the engineering of that bank made more sense than accepting its transformation.

Meanwhile, downstream at South Hadley Falls, debates about flooding passed without much attention. With the potential for flooding so sharp in everyone's mind during the debate over the railroad's route, it seems curious that the railroad did not anticipate what the construction of a new, higher, dam at South Hadley Falls might do to its route where the railroad was intended to run. This is made more curious by the insistence among historians that the railroad anticipated the dam and its attendant industrial development.[58] In 1848, Seth Hunt, the treasurer of the Northampton and Springfield Railroad, described the work that went in to raising

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56 Hadley Town Meeting Records, 31 March 1845, 11 April 1845, 21 November 1845; "Resolve on the Petition of the Town of Hadley" approved 6 April 1846, Mass Acts, Ch. 91, p. 230.

57Levi Stockbridge, Diary, 11 June 1845.

58 Green, *Holyoke*; Kistler, *The Rise of the Railroads.*

the tracks of the road ten feet above their previous level on the run into the New City, which would become Holyoke in 1850, because of the anticipated rise in water caused by the redesign of the dam at South Hadley Falls.[59] Where formerly there had been an upstream dam across the breadth of the river feeding water into the canal and two wing dams at the falls themselves, allocating water to factories along the riverbank, the construction of the dam for the New City ran along the head of the river's most substantial fall. This approach made it possible to raise water to its highest point relative to the canals of the New City without violating a provision in the Hadley Falls Company's charter prohibiting them from raising the water upstream in the vicinity of the Hockanum Island any higher than the canal dam.[60] The fact that the exploitation of the water power entailed raising the dam does not seem surprising—as any investment in developing the water power at the falls would have entailed raising the dam—but the failure of the railroad company to anticipate this element of redevelopment suggests that they did not build their track through the west side of the river with the industrial future of the site in mind. If the railroad company did not anticipate that a new dam would raise the water, they could not have been looking at the Hadley Falls as a natural site for industrial development in any meaningful way. Instead, they thought about this landscape strategically as a means of avoiding the competition of rival railroads.

In this light, it seems more likely that the development of the New City, which would be renamed Holyoke in 1850, was a product of the confluence of a number of interrelated, but not wholly interconnected events that occurred both upstream in Hadley and downstream at South

59 Seth Hunt, Diary, Rauner Special Collections Library, Dartmouth College.

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Hadley Falls.[61] The construction of the railroad preceded the burning of Ames and Lathrop's mills by a year, and preceded the sale of the South Hadley Canal to the Hadley Falls Company by two years. Once all of this consolidation had occurred, and the Hadley Falls Company had purchased land in Ireland Parish had been completed, the ground was set for the development of an industrial city at the falls. It took this web of contingencies for there to emerge a water power site adequate to the visions of the Boston Associates, and thus, we can see that their movement into the area did not drive industrial growth in the Connecticut Valley so much as it took advantage of seemingly propitious moments in the region's history. As it would turn out, the Boston Associates' presence in Holyoke played an important, but by no means determinative role in shaping the character of water use in the city.

Building the Dam at Hadley

In 1848, the Massachusetts legislature issued the Hadley Falls Company a corporate charter that staked out an array of privileges relating to its projected dam on the Connecticut. These privileges and conditions read like an effort at heading off all of the legal issues that had tripped up the Proprietors of Locks and Canals between 1798 and 1827 in their efforts at damming the river while still guaranteeing upstream landowners an array of protections for their concerns about the dam. The first and third provisions noted that the purpose of the company was the construction of a dam, and that the dam should be built across the Connecticut at South Hadley without raising the water above the height of the canal dam. The fourth provision noted that the County Commissioners were competent to establish damages for fishing rights, and the fifth section outlined how the company could purchase those rights. Section six established the

61 "An Act to Incorporate the Hadley Falls Company" Mass. Acts, Ch. 222, passed 28 April 1848, p. 724.

rights of the company to continue operating a navigational canal and take tolls. The seventh section established that the company's charter did not give them the right to interfere with or injure the Connecticut River Railroad. Thus, the charter for the falls company provided for a remedy for the objections that had been repeated in petitions to the legislature every time the dams operated by the Proprietors of Locks and Canals washed out in a freshet. They provided for the protection of upstream landowners from a dam that would modify flowage in any noticeable way, and they provided a means of keeping complaints for damages to fisheries away from the state legislature and the courts.[62]

The construction of the New City in Ireland Parish, West Springfield resulted from the confluence of several independent processes. The river jumped its banks, leaving upstream land uncultivable, the railroad ran across that land and through the undeveloped land on the west side of South Hadley Falls before crossing the falls on the land of the Proprietors of Locks and Canals. In the meantime, the Canal Company confronted declining profits associated with river traffic and the simultaneous emergence of a rival in the railroad,[63] and finally, after the routing of the railroad, a disastrous fire burned down the Ames and Lathrop paper mills, leaving the manufacturing privileges with contractual rights to the flow of water through South Hadley Falls utilized only by the Hadley Falls Company, a small cotton concern on the west side of the river. The Hadley Falls Company gladly sold their name, mills and water rights to investors from Boston at a four hundred percent markup with attached options to invest in the stock of the new

62 "An Act to Incorporate the Hadley Falls Company" Mass. Acts, Ch. 222, passed 28 April 1848, p. 724.

63David Culver and David Stockbridge to the Proprietors of Locks and Canals, 20 March 1833, L&C B-4,c discussed the problems of stagnant toll collection and the difficulty of attracting steam traffic; Treasurer's Reports, 1816-1834 L&C B-3,a, b, e describe a steady dividend rather than a pattern of growth well into the 1830s.

Hadley Falls Company. The Boston investors, who were called the “Cotton Lords” in popular histories of Holyoke because of their interest in building a textile focused mill town, set about designing that town on the model of Lowell.[64]

The sale of the canal to the Hadley Falls Company in 1847 was one small part of a broader speculative process by which the land of Ireland Parish became the property of the Hadley Falls Company in anticipation of the construction of their New City. Like the construction of the railroad, the land speculation underlying the growth of the New City appeared to be the fulfillment of a commonly accepted vision of the site's potential as an industrial city. Nevertheless, the work of acquiring land in Ireland Parish and planning an industrial city there did not commence until after the Northampton and Springfield had settled their plan for the railroad. As was mentioned in the discussion of *Bardwell v. Ames*, the paper mills of Ames and Lathrop burned down in a fire in 1846. Anyone anticipating the acquisition of the water at South Hadley Falls in 1845 would have needed to ignore the decade of litigation and ill will during the 1830s and the proprietors’ continuing difficulties in dealing with tenants and neighbors during the 1840s.

The Hadley Falls Company faced its own difficulties in engineering a dam across the river at South Hadley Falls, and this posed an unforeseen obstacle in the town’s development. The original design called for a dam one thousand feet long and thirty-eight feet high that stopped the flow of the whole river and redirected it into a canal that traced a long s-curve that descended sixty feet, providing water for two strings of factories. The first string consisted of twenty-six mills spaced out every two hundred and fifty feet along a stretch of canal measuring

64 Constance McLaughlin Green, *Holyoke Massachusetts: A Case History of the Industrial Revolution in America* (New Haven: Yale University Press, 1939)

660 feet. Then, a raceway carried the used water back to a second row of factories measuring 950 feet, making space for thirty-eight factories taking advantage of between twenty five and thirty three feet of head.[65]

As of the completion of the dam in November, 1848, these canals remained a monument to the potential energy available for use on the river rather than the kinetic energy of actively working factories. On the date of the dam's completion in November, 1848, a crowd from throughout the region gathered at Ireland Parish to witness the closing of the gates and the filling of the canal. As the gates were closed and the water backed up the dam began leaking through fissures in its timbers and the weight of its millpond threatened the integrity of the dam. Almost immediately the flow through these fissures intensified. At three in the afternoon, as the water reached thirty-six feet above the foot of the dam, and nearly sixty feet above the foot of the falls on the river, the dam gave way and water came crashing out onto the Willimansett Rapids in a torrent. The company's later assessment of this event emphasized that this initial structure had been a temporary dam and that changes in design proved necessary in order to make a permanent structure, but the overall effect of the dam's failure depressed business in the New City. Manufacturers looked warily at the promises of a water power company whose dams failed.[66]

The repair of the dam in 1849 settled conditions for the Hadley Falls Company during the next several years, but they already had some clients on the South Hadley side of the river aggrieved with the interruption of their power. While the dam was being rebuilt, the Carew

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65 *Plan of the New City of Holyoke* quoted in Green, *Holyoke, Massachusetts* p. 26

66 *Report on the History and present Condition of the Hadley Falls Company* (Boston: John Wilson and Son, 1853); For another account of a dam failure on a Connecticut River tributary see *Elizabeth M Sharpe, In the Shadow of the Dam: The Aftermath of the Mill River Flood of 1874* (New York: Free Press, 2004).

Manufacturing Company, a paper company, and the Glasgow Company, a woolens concern, lived without water for a year. The Hadley Falls Company paid them back in water, giving them two years of free water power as a settlement.[67] This approach to negotiation avoided even the possibility of containing, measuring, and marketing the flow of water. Instead, the water passed from the Hadley Falls Company to the Glasgow and Carew Mills consisted of waste water that would otherwise have gone unconsumed. The water power company did not measure the quantities of water involved so as to pay off a debt that would otherwise have required cash compensation. This flexibility in management existed because, although the Hadley Falls Company aspired to market water power, they had not yet built a customer base that made it possible for a market to exist. In this way, the presence of the Boston Associates or the vision of water as a commodity did not make it so. Instead, historical understandings of water, grounded in improvised approaches to its distribution survived during the early years of the Hadley Falls Company's operations.

Indeed, these first water rights, sold to companies working along the site of the factories discussed in *Bardwell v. Ames*, learned the lessons of that case by over-determining the distribution of water in a series of overlapping specifications of the quantity provided. The Glasgow Company received as much water "as may be sufficient according to the Lowell standard of admeasurement to propel ten thousand spindles for making cotton yarn, of number fourteen, and manufacturing the same into cloth: To wit, for every three thousand five hundred and eighty-four spindles, a power equal to twenty-five cubic feet of water per second, (cfs), under a head and fall of thirty feet." The Lowell system correlated the volume of water

67 Barrett, *History of Holyoke Water Power* p. 99.

consumed with the amount of machinery running, making it possible to audit the rate of flow through a water wheel by reference to the number of spindles that it powered, obviating the need to provide a precise measurement of the velocity with which water passed into its flumes. By contrast, the Carew Company received enough water "to operate and propel four paper engines with all the machinery for manufacturing paper." An official with the Holyoke Water Power Company noted that this amounted to about one and three quarters mill powers.[68] The apparent specificity of these grants masked the fact that the Hadley Falls Company could only measure compliance by inspecting the factory to verify that it was not operating excess machinery. The measurements of water's velocity promised in the indentures remained beyond the powers of the Hadley Falls Company's measurement just as they had been beyond the measurement capabilities of Bardwell, Ames, and the various officials charged with settling their disputes over water. As Clemens Herschel later opined, the Holyoke Water Power Company, which would succeed the Hadley Falls Company after an 1859 bankruptcy, "sold, or leased, the right to draw a more or less accurately defined quantity of cubic feet per second out of a systems of canals, as appurtenant to a deeded lot of land; upon which; the general lessee then proceeded to consider his lease as a mere ticket of admission to a sort of free lunch counter, and then drew all the water he could use and waste."[69]

Building up the water power at the New City, which became known as Holyoke when the legislature carved its boundaries out of West Springfield in March 1850, answered only the first

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68 Carew Manufacturing Co. and Glasgow Co., Indentures with the Hadley Falls Co, quoted in Robert Barrett, *The History of the Holyoke Water Power Company* (Holyoke: Holyoke Water Power Company, 1989) p. 99.

69 Herschel, quoted in *History of Holyoke Water Power*, 103.

question about how the Hadley Falls Company might transform the river.[70] The saturation of the cotton textile market in the early 1850s meant that few textile mills sought to relocate to Holyoke, while the owners sought to keep the town's focus on cotton because of concerns about the pace of water use.[71] Cotton textile mills typically stored water overnight to intensify mill powers during a day shift, but paper mills used water on a twenty-four-hour basis to power continuous and virtually unmonitored processes of pulping to break down cellulose and process fibers. These distinctions in the management of water contributed to conflicts over how it ought to be stored and distributed, prompting new conflicts over the measurement of water consumption rates. While textile mill owners advocated the closing of canal gates during the night and on weekends to store as much water as possible for use during the day, paper mill owners advocated the maintenance of a continuous twenty-four-hour flow. Thus, keeping the two forms of manufacturing separate made it easier to optimize water use.

In 1870, the Holyoke Water Power Company hired James Emerson, an engineer who had trained at Lowell, to design and operate a testing flume in their canalway. This flume, used to monitor the optimal flow of water through turbines, came into broad use throughout the United States because of Emerson's skill in promoting testing as an element of turbine marketing and his ability to use the results of these tests to make turbines into their own water meters. At the same time, the calculations carried out at that flume helped to overcome many of the issues of scale that had formerly beset the measurement of the quantities of water flowing through turbines. A decade after the construction of the testing flume, Clemens Herschel, another engineer associated

70 "An Act Incorporating the Town of Holyoke" Mass. Acts, ch. 71, passed 17 march 1850, p. 323.

71 Hunter, *Water Power in the Age of Steam.*

with Holyoke Water Power assisted the development of the Venturi water meter, a device that measured the rate of flow in process water, enabling the water power company to measure all of the water consumption occurring in their canals. Measuring and containing water had played a key role in controlling its flow. These technologies played a key role in making water a containable object of management rather than an uncertain element of the world at large.[72]

Conclusion: The Decoupled Oxbow

During the course of the 1840s, the companies working at South Hadley Falls and towns with upstream meadows including Hadley, Northampton, and Easthampton worked to decouple the interconnections between their landscapes. A flood control program in Hadley blocked out the high water exacerbated by the dam downstream. Meanwhile, the Hadley Falls Company bought out the remaining fisheries, neutralizing their claims to a stake in managing the river on a regional basis. In some respects, this resulted from the changing character of the rivalries that beset neighboring towns. Whereas the Proprietors of Locks and Canals had stood against every upstream community, by 1847 the Hadley Falls Company benefitted from a railroad that naturally divided Hadley and Northampton. Their petitions lost some sting when they could no longer mobilize the whole of Hampshire County with an argument that the dam interrupted their everyday lives. Nevertheless, the Hadley Falls Company approached their goal of commodifying water as a source of power for manufacturing within the boundaries that the Proprietors of Locks and Canals had already established. They did not push to acquire more water by flooding new

72 Edwin T. Layton, "Scientific Technology, 1845-1900: The Hydraulic Turbine and the Origins of American Industrial Research," *Technology and Culture* 20, no. 1 (1979): 64–89; James Emerson, *Treatise Relative to the Testing of Water-Wheels and Machinery: With Various Other Matters Pertaining to Hydrodynamics* (Springfield, Mass.: Weaver, Shipman & Company, 1881); Herschel, *The Venturi Meter.*

lands upstream, but rather they worked to quantify and effectively price the water that they had. The Hadley Falls Company and its successor, the Holyoke Water Power Company moved the jurisdiction for complaints out of the state legislature and into the county courts, and this decision localized and simplified the process of litigation and eliminated the simultaneous legal and political conflicts that had historically made the management of the canal at Hadley Falls so contentious. At the same time, the defeats in the Hadley Falls Company's charter and the conflicts over the establishment of the Connecticut River Railroad led Hadley and Northampton—former allies in the fight against dams at South Hadley Falls—to make their own separate peace with the transformation of the river's flow. The first levees and bank revetments along this reach of Connecticut River began arising in the 1840s in an effort to mitigate erosion from the increasing speed of the current following the river's changing course and the transformation of the Oxbow.

Thomas Cole's *Oxbow* might be read as containing a range of portents of the coming deluge. Storm clouds loomed over Mount Holyoke and Cole painted patches of cleared forestlands on the opposite bank of the river that spelled out the Hebrew characters for Noah. The flood that actually transformed this valley, however, traced a very different course across the landscape than any flood that Cole anticipated. His painting depicted the thread of the river as a placid line running across the length of the canvas, subdued by agricultural civilization. The flood reshaped Hadley and Northampton—and reverberated up- and down-stream through the hydrologic connections intertwining those meadows with the South Hadley Falls and the Northampton Bridge. Residents of Hadley understood this principle, thus their protests against trying to turn the Oxbow into reengineered farmland and their concerns about the role that a causeway running across the former Oxbow would play in creating new lake flood hazards.

The view from Mount Holyoke diverged dramatically from the view along the banks of the river. Victor De Grailly and Thomas Chambers' paintings of the Oxbow neglected to include the new channel or the train line built across its island during the 1840s. Similarly, illustrations for Richards' account of the Oxbow for *Harper's* neglected to mention its new course. They hinted at it by mentioning the "wayward humors of the waters" and reproduced Bartlett's image of the Hockanum Bend as if it were unbroken. Edward Hitchcock provided one of the first depictions of the new Oxbow in his 1841 *Final Report on the Geology of Massachusetts*, which reproduced Bartlett's lithograph of the river with the new channel hastily etched into the plate—an act visible from the absence of cross hatchings at the new channel while such shading appears throughout the remainder of the river's course.

Figure 7: Edward Hitchcock, after William Bartlett, *The View from Mount Holyoke*, in *Final Report on the Geology of Massachusetts*, (Northampton: Butler, 1841) following p. 831, Digitized for archive.org by National Library of Medicine.

In 1845, Hitchcock participated in the beginning of Mount Holyoke's tradition of Mountain Day. His observations in connection with the clearing of a new path for hiking up Mount Holyoke noted the geological forces that had shaped the valley—much in line with his observations outlined in chapter two—and concluded that "the latest geological agency that has operated on the Valley of the Connecticut, is the united physical forces of the Senior and Junior classes of Amherst College. This is undoubtedly a new force in geological dynamics...

Geologists will undoubtedly introduce it into their future works, as a most important agency in producing *erosions*."[73] The consequences of this work was not, however, an enriched knowledge of human agency in shaping the landscape, but instead an increasing difficulty in seeing the interconnections between industrial and natural flows in the valley. When one student from nearby Mount Holyoke College took in the view in 1853, she "looked at the woods, and the waters, but saw not the bridge and the rail-car. Suddenly a shrill whistle broke the spell, and most provokingly put an end to all my poetizing. I woke to find myself in this 19th century of steam and progress, when art seems so vainly striving to outdo nature in beauty as well as utility."[74] This observation treated the cultivated landscape as an edenic paradise only newly disturbed by the railroad and industrial development. Ultimately, this speaks to the difficulty with which many observers of the landscape standing atop Mount Holyoke managed to accept the new world that they lived in, a world as much industrial as pastoral. The image of Mount Holyoke as a place of wild respite within a civilized valley, and a place where the evidence of industry fell away before the beauty of the landscape would persist with remarkably little commentary on its obvious contradictions until well into the twentieth century.

This dichotomy made Mount Holyoke into a place suited for the observation of wildness in the breach. Vacationers traveling to the valley climbed Mount Holyoke to observe the pastoral landscape associated with Cole's Hudson River School. They also purchased and sent postcards depicting the millions of board-feet of logs that annually floated downstream as part of the mass log drives that commenced after 1870. Booms guided this lumber into a storage yard making use

73 Edward Hitchcock, *Reminiscences of Amherst College* (Northampton: Bridgman and Childs, 1863) p. 226.

74 Harriet Lane, quoted in Susan Danly, "Mount Holyoke: 'The Grandest Cultivated View in the World'" *Changing Prospects* p. 16.

of the old Oxbow Lake that Cole had so lovingly depicted. This abandoned river channel had become an industrial storage facility for the Connecticut River Lumber Company.[75] Nevertheless, in the imaginations of tourists, looking out across the breadth of the landscape that Cole had depicted helped them to elide these industrial developments and imagine themselves witness to a valley unchanged by time.

Down the mountain at Hockanum, no such assurances were available, and the communities living along the riverbanks began rethinking their relationship with their meandering neighbor. Town meeting decisions in 1845 prompted appeals to the legislature for assistance in securing the banks of the Connecticut River. And as this assistance came, it proved the beginning of a broader transformation of the land along the Hadley meadows from an open landscape subject to seasonal flooding into a landscape hardened against floodwaters. Controlling the long-range geological transformation of the landscape emerged as more important than working with, and benefitting from the waters that annually flowed across the landscape. Geological history went from being a lived element of the landscape to a technical problem necessitating engineering, a position that communities up and down the river had resisted for the last fifty years.

The same series of accidents—ranging from the river's changing course to the destruction of rival private mills along the South Hadley Canal—provided an opportunity to transform the

75 William G. Gove, *Log Drives on the Connecticut River* (Littleton, NH: Bondcliff Books, 2003); Hugh Leighton Co., *Logging at the Ox Bow on Connecticut River Near Holyoke, Massachusetts*, Post Card, N.D. Probably before 1864, Logging Postcard Collection 13475, Fairbanks Museum, St. Johnsbury, VT; Raphael Tuck & Sons, *Easthampton, Mass. The Log Pile at the Ox-Bow*, Post Card, N.D. Probably before 1914, Logging Postcard Collection 13475, Fairbanks Museum. Robbins Bros., *Logs on Connecticut River, Near Mt. Tom, Holyoke, Mass.*, Post Card, N.D. Probably before 1914, Logging Postcard Collection 13475, Fairbanks Museum.

South Hadley Falls, but we should not follow the progressive historians of the 1930s in assuming that the growth of Holyoke was inevitable. It was by no means inevitable that the South Hadley Falls would become a major industrial city whose footprint extended up into the remnant oxbow lake that surrounded Hockanum Island. It was by no means inevitable that the railroad built between Northampton and Springfield would make it possible to build up that town, and it was by no means inevitable that the erosion of land as the river changed its course would encourage the Hadley Town Meeting to prioritize the hardening of the riverbanks in the name of flood control. It took accidents including the elimination of water rights holders at the falls through fire and efforts at resisting the charter of the Franklin and Hampshire Railroad Company to bring the residents of Hadley to this point.

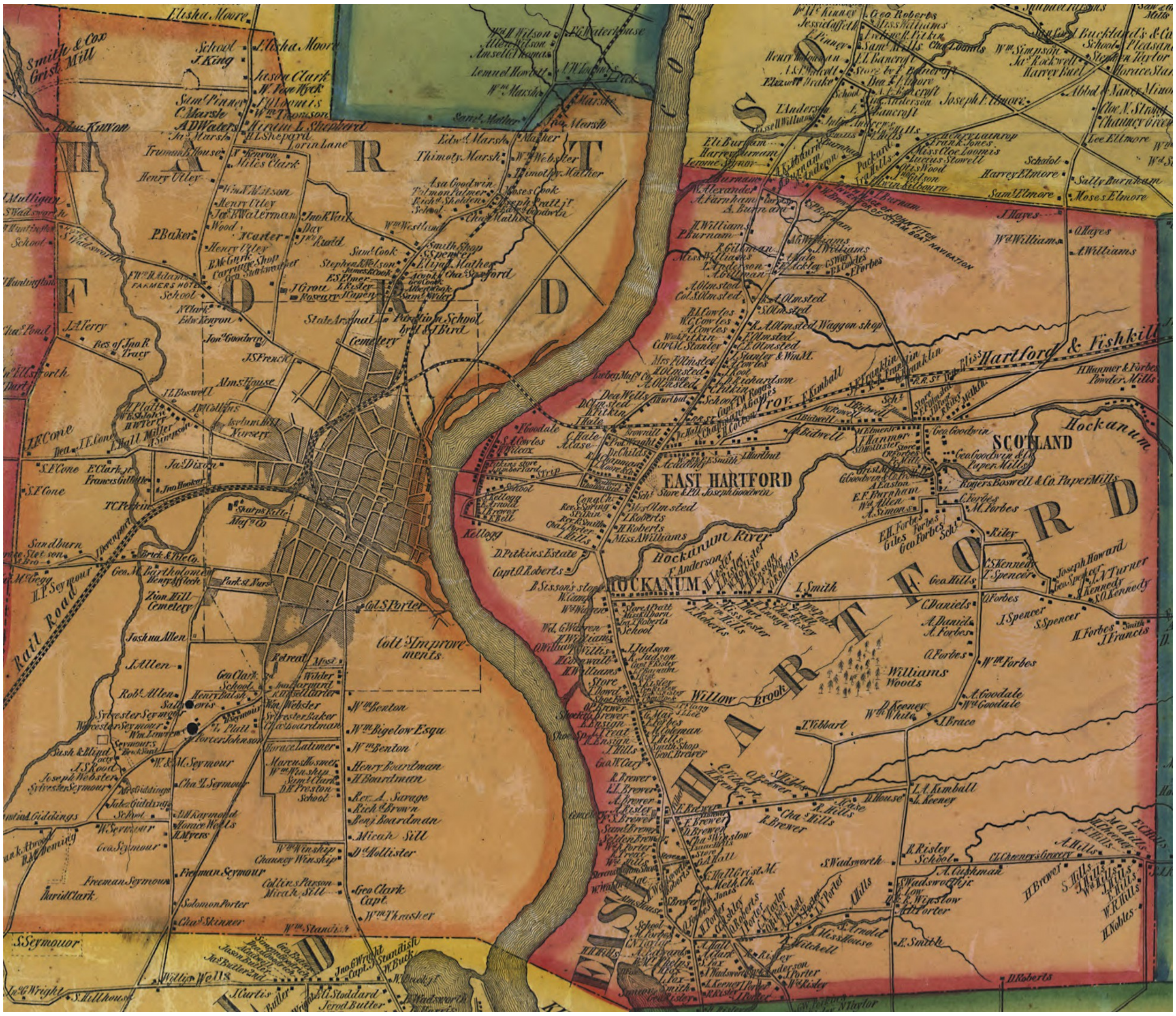

Figure 8: Detail from C. T. Smith, "Map of Hartford County, Connecticut," 1855, Retrieved from the Library of Congress, https://www.loc.gov/item/2001620484.

Chapter Six:
High Water in Hartford: Ways of Knowing and Adapting to Floodwaters in the Connecticut Valley's Largest City, 1836-1873

Hartford, Connecticut has the oldest continually running record of flooding in the United States. This record did not originate amidst disastrous flooding, but rather in a concern for the consequences of erosion within the region. Residents of East Hartford looked warily upon floodwaters in the Connecticut River, not because flooding presented a singular or unexpected disaster, but because floods induced erosion. Rather than interrupting life in clock time, it interrupted life in a geological timeframe. One 1836 complaint recalled that the river had "swerved to the eastward forty or fifty rods [750 feet] within sixty years."[1] In *Bigelow v. Hartford Bridge Company* (1842), property owners on the East Hartford Meadow held the bridge responsible for ice jam floods and these floods contributed to the erosion of the bank along the north side of the Meadow, making it more likely that the river would cut a new course through their property.[2] By contrast, the bridge company and the city of Hartford argued that the cutting of a new channel would only occur through the erosion of gullies on the south side of East Hartford Meadow and would not cause the wholesale redirection of the river. Answering questions about whether the overflowing of the riverbank on the north side of the meadows was cutting a new bed for the river as a whole had significant consequences for decisions about how to design drainage causeways on the Hartford Bridge itself. The competing premises of the bridge company and residents of the East Hartford Meadow reflected different perspectives on the role of human agency in flooding. While the residents of East Hartford viewed the bridge as a contributor to ongoing flood problems, the Bridge Company countered that their bridge had been built to specifications that removed it from the equation in assessing flooding.

Bigelow v. Hartford Bridge Company did not mark the beginning of this controversy. The Hartford City Council had investigated this theory in 1836. Their inquiry responded to a direct question concerning the potential for the river to jump its banks and abandon Hartford's wharf-lined riverbank. Regarding this, they reassured the city that the river would not change course

1 Seth Terry, "To the Honorable Court of the Common Council" *Connecticut Courant* 13 June 1836, p. 3

2 *Bigelow v. Hartford Bridge Company*, 14 Conn. (1842) 565.

until centuries of flooding reshaped East Hartford as a whole.[3] Their engineers projected that the river might wash a new channel from the southeastern corner of the meadows upward to the northwest bank that stood at the center of erosion, but not the opposite. This conclusion rested on their observation that a natural levee at the north end of the meadow blocked the flow of the water, and then the relatively level character of that terrace in its slow decline toward the southeast acted as a dam preventing the river from opening up a new channel. The Council concluded by addressing the possibility of protecting the banks of East Hartford. They dismissed such a plan because it would be impossible to guess where the new channel would be cut and impractical to reinforce the whole of the peninsula from erosion.

The courts reached a less confident conclusion in *Bigelow v. Hartford Bridge Company*. The case emerged because the bridge company planned to replace a wooden dry bridge four hundred feet in length with a packed earth causeway with only four arched culverts twenty feet in diameter. Bigelow sued the bridge company arguing that this would increase flood risks in East Hartford. The Hartford County Superior Court agreed that "the waters of Connecticut River have been accustomed for many years, to set back through three ravines, or large drains, a considerable distance above the causeway, and to pass through the Eastern channel, and through the causeway, at the place where the dry-bridge stood, and under it, in a broad deep and rapid current."[4] Bigelow and his neighbors worked to establish much the same argument that had animated the city's investigation of the banks of the river at East Hartford in 1836. The key question being whether the bridge was adequately designed to remove it from the equation when

3 Ibid; Terry, "To the Honorable Court of the Common Council."

4 *Bigelow v. Hartford Bridge Company*, 567-8.

considering problems of flooding, or if it would continue to play an active role in shaping ice jams, particularly as they built up on the meadows themselves.

Although Bigelow did not succeed in his suit, his contribution to the bridge controversy appears to have made flooding a matter of public record. Justice William Storrs absolved the company of any damages, but he also articulated a set of conditions that would indicate whether the company continued to avoid exacerbating flood risks in the future. He made a series of predictions, and these predictions set up the conditions under which the court might turn out to be mistaken, leaving a door open to future cases. Storrs predicted that the floodwaters crossing the meadows would not rise faster, rise higher, or persist on the land longer than they previously had. He predicted that increasing any of these variables in flooding would not cause greater damage to buildings constructed upstream. Finally, he predicted that any damages that might occur would be so minor that they would be indistinguishable from the ordinary wear and tear on the buildings. As a result, if such an outcome did occur, the Bridge Company would be liable for damages, but otherwise it would stand blameless.[5]

The Bridge Company came away from this case with an awareness of the importance of keeping a careful record of flood heights. If they proved uninformed about these conditions and damages did occur on the properties north of the bridge and its causeway, the proprietors would lose a valuable means of asserting their innocence of causing those damages. Moreover, when debating petitions before the legislature for the inspection or redesign of the bridge, they needed to be able to mobilize an explanation of how flooding occurred. Accordingly, every year during the spring freshet a bridge employee would paint a high water mark on the property, denoting

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5 Ibid., 574.

that year's flood.[6] While this written record initially served a particular purpose in reinforcing the bridge's legal claims that it was not an agent of erosion, it eventually became a means of comparing the river's height and the rate of its rise to historical floods. These data would shape the next two decades of urban development in the city and eventually become a key element in journalistic accounts of flooding.

What should we make of this flood height record originating not in flood control, but rather in debates about whether the human presence on the floodplain exacerbated or lessened flooding? The bridge company's attention to the river's flow through the bridge and its potential contributions to erosion made Hartford a hydrological pioneer. The river gauge at the Hartford Bridge—and at its successor, the Bulkeley Bridge—possesses the oldest continually maintained record of flood heights in the United States.[7] The role of flood records in shaping Hartford's development drives three interrelated questions explored in this chapter. What did the city of Hartford do with its flood records during the decades separating the beginning of recordkeeping and the beginnings of levee building? How did ordinary people living on Hartford's East Side deal with flooding? Why did the city see the development of private flood control structures such as the levees surrounding the Colt Firearms Factory and the Connecticut Valley Railroad embankment while rejecting a municipal flood control effort? The answers to all three of these

6 During the 1850s, the records kept by the Bridge Company incorporated flood height measures taken every six hours during high water, which encouraged the calculation of rates measuring the river's rise and fall.

7 Flood crest records can be found on the National Weather Service Advanced Hydrologic Prediction Service web site, water.weather.gov/ahps2/. Cincinnati, Ohio and New Orleans, Louisiana each have flood records on these pages that date to the late 1850s. Hartford's data is at Advanced Hydrologic Prediction Service http://water.weather.gov/ahps2/crests.php?wfo=box&gage=hfdc3&crest_type=historic.

questions reflect how the City of Hartford maintained a rural way of living with water amidst a growing industrial city.

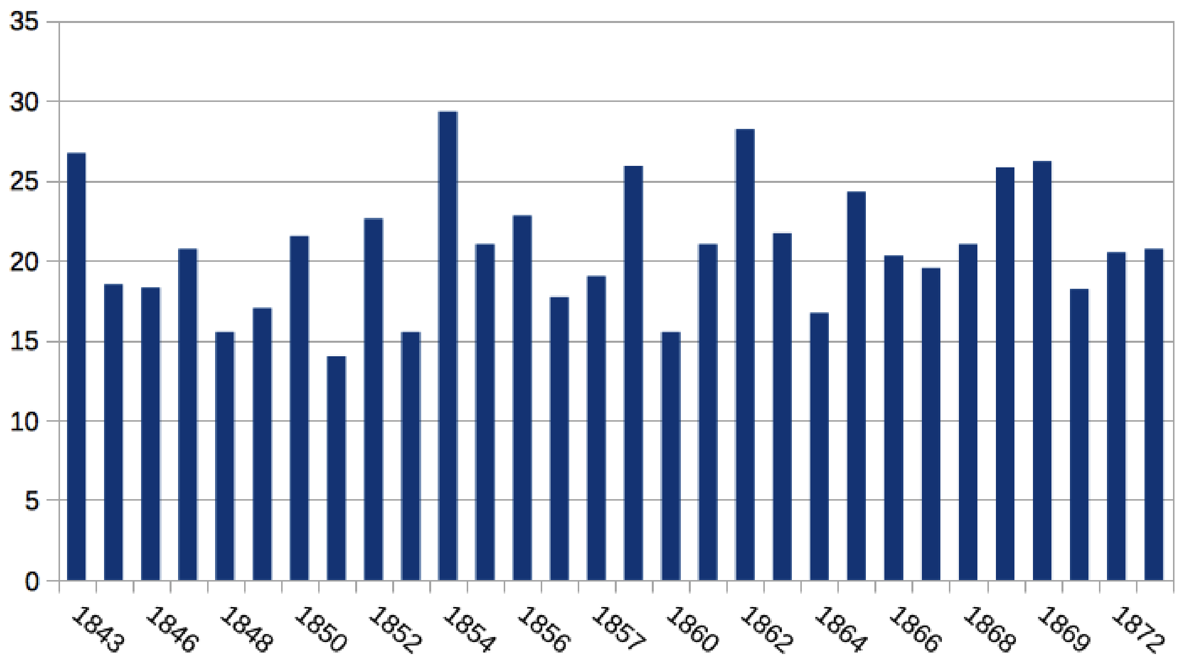

Figure 9: Flood Heights in Hartford, 1843-1873, National Oceanic and Athmospheric Administration, Advanced Hydrologic Prediction Service, http://water.weather.gov/ahps2/crests.php? wfo=box&gage=hfdc3&crest_type=historic

Rural ways of working with water, much like the observations of the spring freshet described in the first chapter, took for granted that flooding occurred annually in its season and anybody living or working in the floodplain needed to adapt to it. Floods occurring in sync with seasonal time, even remarkably high floods, did not prove disastrous.[8] Owners of small businesses and residents of tenements also shared this relationship with seasonal flooding, and across Hartford's East Side the community came together in floodwaters, lifting their possessions out of basements and up into second floors and attics so as to avoid water damage. The ordinariness of these adaptations comes through in the language of newspaper reporting describing floods and the laconic observations of diarists describing their toll in Hartford.[9]

Residents of Hartford's East Side lived with an experience of ordinary flooding, and the records of their working practices in floodwaters reveal a little appreciated element of the nineteenth-century city. Taking this language seriously shifts this history of flooding out of a context dominated by stories of disaster and into a context dominated by questions of how to live with water. Scholars working on European river management practices argue that communities floodwaters experienced flooding as "events that belong to a recognizable cycle of destruction

8 Rebecca Solnit, *A Paradise Built in Hell: The Extraordinary Communities That Arise in Disaster* (New York: Viking, 2009); Kai Erikson, *A New Species of Trouble: Explorations in Disaster, Trauma, and Community* (New York: Norton, 1994); Theodore Steinberg, *Acts of God: The Unnatural History of Natural Disaster in America*, (New York: Oxford University Press, 2006); Naomi Klein, *The Shock Doctrine: The Rise of Disaster Capitalism*, (New York: Metropolitan Books, 2007).

9 A contrast to casual flood reporting can be seen in the upland experience of flooding. "A Correspondent from West Simsbury" *Connecticut Courant* 30 March 1801; This definition of disaster extended beyond the nineteenth-century observer. It applied in Lowell Carr, "Disasters and the Sequence-Pattern Concept of Social Change" *American Journal of Sociology* 38 no. 2 (September 1932): 211 which provided the first succinct description of disaster as the disruption of social and cultural order. Judging from the contributions to E. L Quarantelli, ed., *What Is a Disaster?: Perspectives on the Question* (London: Routledge, 1998), little has changed in that definition for many people.

and renewal."[10] This chapter carries such a perspective across the Atlantic and focuses on how an American city lived with the cycles of flooding. In doing so, it reveals a vision of the public good in terms of dealing with flooding that existed outside of the narrow boundaries of flood control infrastructure. The city council used its knowledge of flooding to direct efforts at drainage and water management, but did not use this knowledge to keep residents out of floodwaters or assert broader control over the river's flow.[11]

The floodwaters that covered Hartford's East Side posed an infrastructural challenge rather than an existential one. While cities such as New Orleans and St. Louis built levees to keep out water, Hartford left its riverbanks open to inundation and lived with the certainty of flooding.[12] While this left them wetter in lower floods, it also saved the surprise of inundation in higher floods. As such, the history of flooding on its streets touches on the mundane and absurd more than the heroic and the tragic. Without diminishing the real human suffering that could occur amidst the floodwaters in Hartford, this chapter looks at the experience of flooding as it revealed an infrastructure of adaption to flooding within the city. Governing a flood-prone city demanded the integration of water knowledge ranging from flood patterns to groundwater flows in the everyday management of issues such as sewer drainage and street grading. At the same time, community members living with floodwaters needed to think about the urban landscape

10 René Favier and Anne-Marie Granet-Abisset, "Society and Natural Risks in France, 1500-2000: Changing Historical Perspectives," in *Natural Disasters, Cultural Responses: Case Studies Toward a Global Environmental History*, ed. Christof Mauch and Christian Pfister, (Lanham, MD: Lexington Books, 2009), 103.

11 Steinberg, *Acts of God*.

12 Ari Kelman, *A River and Its City: The Nature of Landscape in New Orleans* (Berkeley: University of California Press, 2003); William Cronon, *Nature's Metropolis: Chicago and the Opening of the Great West* (New York: Norton, 1991) describes the challenges that the levee at St. Louis posed to the river trade.

vertically as well as horizontally, knowing where to move their goods up as the water rose. Consequently, the recurrence of flooding shaped how people looked at the city on Hartford's East Side.

Historians of urbanization in the Early Republic and Antebellum periods emphasize the unsettled character of city life in the nineteenth-century United States. Their accounts of issues ranging from literacies and underground economies to politics and animal husbandry have illustrated how the new cities that arose amidst the industrialization of the nineteenth century did not meet the blueprints imagined by middle-class reformers.[13] The mitigation of urban environmental problems ranging from sewage treatment and water-supplies to trash collection and animal regulation between the late nineteenth century and the twenty-first century has left a stark contrast between the possible approaches to living with nature that existed in the mid-eighteenth century. Like many of these works in urban history, this chapter explores the many possible ways of living with the natural world that existed at the outset of urbanization and asks why the particular practices of flood control that arose along the banks of the Connecticut came into play when they did. The central question of this chapter concerns why the city of Hartford proved so ready to allow river free reign over the dry land during the 1840s, and what events between the 1850s and the 1870s prompted the turn to levee building. During the 1850s new forms of infrastructure emerged that required community adaptations to industrial modifications of the landscape. In the public life of the East Side, railroads, telegraphs, sewer systems,

13 Peter C. Baldwin, Domesticating the Street: The Reform of Public Space in Hartford, 1850-1930, Urban Life and Urban Landscape Series (Columbus: Ohio State University Press, 1999); David M. Henkin, *City Reading: Written Words and Public Spaces in Antebellum New York* (New York: Columbia University Press, 1998); Catherine McNeur, *Taming Manhattan: Environmental Battles in the Antebellum City* (Cambridge, Massachusetts: Harvard University Press, 2014).

waterworks, and gasworks made the public disruptions occasioned by flooding more dramatic. In the private businesses of Hartford's South Meadow, the construction of the Colt Firearm factory represented a parallel development that revealed some of the difficulties and limitations that beset flood control efforts and slowed the city's adoption of public flood control systems.

This chapter discusses strategies for adapting to floodwaters and managing the city amidst those floodwaters. It begins by describing the original settlement of Hartford's East Side, including the development of the Hartford Bridge and the bridge's initial issues with flood damage. In this section it revisits the history of the bridge controversy, exploring how the City Council's attitudes about private property shaped its attitude toward flood control. Secondly, it explores the developments of the 1850s, where the Colt Firearm Company used knowledge of flood heights in designing a levee to protect its factories in the South Meadows while the city government used that same data to establish a drainage network for the East Side. The third section looks at floods that occurred in the wake of these developments, asking how the improvements to the landscape worked in practice and what this tells us about flood control. Between 1868 and 1873 the city considered a variety of levee plans, each of which set very different priorities about what to protect from flooding and how to protect it. Debates over these plans revealed disagreements about how levee building would shape groundwater and drainage. These last stories provide a closing point for the chapter, where we can see clearly what forms of land use attracted flood control investment and how these related to the larger questions about land management in the city.

How Hartford's East Side Grew Out of the Little Meadow

Hartford's East Side neighborhood originated in a set of warehouses built along the slips and wharves along the riverbank in the town's Little Meadow. These warehouses and attached residences provided a home for weighty Hartford Merchants such as Jeremiah Wadsworth in addition to ordinary people such as the cooper Josiah Beckwith.[14] This early development hardly looked like a city. Here Meadow Creek flowed into the Connecticut at the end of a mile-long slough running out of the North Meadows. The land then ran south to a waterway currently called Park River, but formerly referred to as the Hog, Little, or Mill River. The south end of the Little Meadow ended in a peninsula of land known as Dutchmen's Point. The river eroded the Little Meadow between the 1640s, and the 1820s, but infill by East Side property owners extended the shoreline again between the 1820s and 1868. The region's land area diminished as its role as a port declined, but regrew as it became a center for manufacturing and faced an attendant crisis in working class housing availability.[15] The dynamism of the landscape would contribute to debates over whether levees could regulate surface and groundwater flows later in the century.

The population and economics of Hartford and its neighbor East Hartford changed dramatically during the first four decades of the nineteenth century. Population growth rates in Hartford mushroomed from fourteen percent between 1756 and 1820 to thirty six percent

14 “Hartford Town Lots,” 1800 Hartford History Center, Hartford Public Library; The depiction on this map was verified against the listings in Frank D. Andrews, *Hartford Business Directory, 1799* (Vineland, NJ: Published by the Author, 1910), where it appears that Jeremiah Wadsworth had a house on Main Street and also a house along the wharves.

15 Samuel Porter “Hartford in 1640: Prepared From the Original Records” map, 1838; *Report of the Committee on the Proposed Hartford Dyke* (Hartford: Wiley, Waterford, and Eaton, 1867).

between 1821 and 1880.[16] Small patches of warehouse building on the riverside became bustling neighborhoods crowded with development. Like many nineteenth-century floodplain cities, Hartford became increasingly central in regional commerce. This expanded the public perspective on the floodplain in two interconnected ways. The transportation infrastructure leading into town provided the backbone of public commerce and encouraged city growth. At the same time, the city's growing population made possible the anonymity of individual city residents, and this made new forms of storytelling that focused on people's everyday lives an element of the city's newspapers.

The 1801 flood, which was discussed in the first chapter, sometimes called the Jefferson flood in deference to the fact that it coincided with Thomas Jefferson's inauguration, defined relationships with floodwaters in the nineteenth-century Connecticut River Valley. It received notice in the *Connecticut Courant* because the river had not reached such a height since 1692, and "people were scarcely able to secure their most valuable property in stores and houses before the buildings were filled with water. Every family in that part of town which lies near the river, has been forced to flee for refuge among their neighbors; many of the families were taken from the windows into boats."[17] Clearly, this noteworthy flood disrupted people's lives, but nevertheless the event of flooding consisted of efforts at rescuing property and then fleeing to

16 Data are from *Geer's Hartford City Directory* (Hartford: Steam Printing Company, 1896) p. 685. Other key sources include Bruce Daniels, *The Connecticut Town: Growth and Development, 1650-1790* (Middletown, Conn.: Wesleyan University Press, 1979); Howard Lamar and Christopher Bickford eds. *Voices of the New Republic, Connecticut Towns 1800-1832* Memoirs of the Connecticut Academy of Arts and Sciences v. 26-7 (New Haven, Conn: Connecticut Academy of Arts and Sciences, 2003); For an understanding of the broader demographic transitions ongoing in the valley, see. Christopher Clark, *The Roots of Rural Capitalism: Western Massachusetts 1780-1860* (Ithaca, NY: Cornell University Press, 1990);

17 "By Reason of the Late Heavy Rains" *Connecticut Courant* (Hartford) (23 March 1801): 3.

high ground in good order. Perhaps more importantly, the 1801 flood lived on the public memory of high water, being marked on local buildings, and having its high water mark preserved and transposed onto the top of new buildings—including the Hartford Bridge—as a reminder of the river's potential for flooding.

The design requirements of the Hartford Bridge reflected public memory of the 1801 flood that had inundated the East Side of town up to a hitherto unprecedented twenty-nine feet. Their charter reflected these fears by specifying that the bridge's piers should be built to a height of thirty-two feet. Secondarily, the legislature worried that ice and timber drawn downstream by floodwaters would dam the passages under the bridge and exacerbate flood damage on lands upriver. The three feet of space between the maximum known flood height and the bridge's floor was intended to help forestall such an occurrence. The legislature also specified that the bridge's piers should be designed with ice-breakers. The upstream sides of the piers extended upstream in a wedge formation intended to disrupt the flow of ice blocks and prevent their accumulation under the bridge's floor. Ice jams, the refreezing of ice floes that had previously broken up in an upstream thaw, caused a significant number of winter and spring floods.[18] The accumulation and refreezing of river ice could impound water in volumes out of all proportion to the channel of the river or its average flow during the spring thaw. This led the legislature to mandate the construction of a causeway, or dry bridge, leading across the East Hartford Meadows. This causeway only reached the height of twenty feet and roughly 1000 feet of its twenty five hundred foot length consisted bridging across ordinarily dry meadowland that allowed for drainage. All of

18 George Wright, *Crossing the Connecticut* (Hartford: Smith Linsley, 1908) p. 9 has a picture of the Enfield-Suffield Bridge that depicts ice-breakers of the type described here.

these specifications reflected an awareness of the potential for a bridge to exacerbate flood risks and also fall victim to those risks.

The design specifications for the Hartford Bridge did little to protect it from floodwaters in 1818. Three days rain, beginning on the first of March, caused the river to rise, and its ice cover broke apart as it adjusted to its new height. The resulting ice floes measured between eighteen and twenty-four inches thick in many places, and although the height of the river went unrecorded, it proved high enough to lodge a wall of ice into a jam beneath the spans of the Hartford Bridge. The force of water and ice backed up by this jam carried off two of the bridge's five arches. Thomas Robbins, a minister from East Windsor, about ten miles upstream and across the river from Hartford observed the destruction as it delayed his travel to the city on March third 1818. He witnessed the bridge's destruction and stayed by the riverside to reflect on the traffic that continued to cross the river in a ferry as "after an hour or two it was tolerable boating until one o'clock. the ice then came from above and run till night."[19] Robbins continued to watch the progress of the ferry negotiating the high water and the spectacle of the floodwaters, but waited to cross until the next day.

This particular flood merited special mention in the *Connecticut Courant* because of the public importance of the Hartford Bridge. The *Courant's* main audience lived outside of Hartford and its political reach extended across New England, where it served as a standard bearer for the conservative and elitist politics that would find a home in the Federalist and Whig parties. Like many nationally focused newspapers, it eschewed local news during the early decades of the

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19 Thomas Robbins, *Diary of Thomas Robbins, D. D., 1796-1854* (Boston: Beacon Press, 1886) 1:734 The same page also described the thickness of the ice floes running downstream in the 1818 flood.

nineteenth century. In the case of the flood, it even reprinted a description of its damage from its crosstown rival, the *Connecticut Mirror.* Even the *Mirror's* coverage opened with an excuse for covering something so mundane as a flood by noting that the destruction of the bridge was "not an event that interests only one or two individuals, but one in which the whole community is concerned."[20] The legislative response to the destruction of the bridge proved far more interesting to the *Courant* than the initial freshet that destroyed the span. The Hartford Bridge Company used the necessity of rebuilding the bridge as a means of renegotiating its charter so as to eliminate a ferry operated by the towns of Hartford and East Hartford in direct competition with the bridge. The legislature granted that concession, but demanded that the bridge piers be raised four feet and include a draw on its west end that could help facilitate the passage of ice.[21]

The *Courant* was not alone in limiting the discussion of flooding to its relationship with transportation. State laws specifying responses to flooding between 1800 and 1841 focused exclusively on protection of transportation services.[22] Bridges, like turnpikes and ferries, stood in a gray area between public and private enterprises during the course of the nineteenth century. The Hartford Bridge perhaps more than most, as its proprietors took the town of East Hartford to court over the operation of a ferry in violation of the bridge company charter. Residents of East Hartford viewed the bridge company's monopoly and its claim to an exclusive private right to

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20 "Distressing Calamity" Reprint from the *Connecticut Mirror, Connecticut Courant* 10 March 1818 p. 3; On the standards governing the press in the Early Republic see Hazel Dicken Garcia, *Journalistic Standards in Nineteenth-Century America* (Madison, Wis.: University of Wisconsin Press, 1989); Carol Sue Humphrey, *The Press of the Young Republic, 1783-1833* (Westport, Conn: Greenwood Press, 1996).

21 "Connecticut Legislature, May 30" *Connecticut Courant,* 9 June 1818.

22 "An Act Concerning the Ferry and Causeway between Hartford and East Hartford" Resolves and Private Acts of the State of Connecticut v. 3 Title 5 at 277 (1841); "An Act Relating to Ferries" Public Statutes and Laws of Connecticut Title 33 Section 9 at 169 (1821)

control traffic across the river as a sinecure designed to gouge the public even as its structure exacerbated flooding in their meadows. While the *Courant* could describe the destruction of the bridge as a matter of public interest, residents of East Hartford sought legislation reinstating the ferry and later shored up the ice cover on the bridge to encourage travelers to bypass its tolls. These debates over what constituted public infrastructure foreshadowed debates over levee building.

Private Levees, Public Sewers, and Record Floods: Hartford in the 1850s

When reviewing the impact of the spring floods in 1852, the *Courant* argued that given "the direct expense, injury, and loss of property, the delay in business to the large manufacturing establishments and loss of time to the thousands thrown out of employment, would seem to be a fit time to call upon the City Authorities for a proper investigation on the part of the City as to the utility of raising Commerce and Potter street, so as to form a dike some 24 feet above low water."[23] The strengths of this proposal lay in its identification of a public need, the maintenance of continuous employment among the working people of Hartford, and the effort at identifying a public space that they could reshape to meet that need, Commerce and Potter streets. Moreover, the *Courant* proposed this levee off the cuff, devoting less than an inch of column space to the idea and failing to revisit it in later issues from that year. Nevertheless, the basic facts of their argument outline the political logic that simultaneously made levees conceivable as contributions to the public welfare even if the city lacked adequate public space to build them.[24]

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23 "Overflowing of the Connecticut" *Hartford Courant* 24 April 1852.

24 William J. Novak, *The People's Welfare: Law and Regulation in Nineteenth-Century America* (Chapel Hill: University of North Carolina Press, 1996).

The *Courant* focused so closely to the use of public property to achieve an identifiably public goal that it failed to communicate any realistic conception of how much space would be necessary for a levee. Similar structures—discussed in greater depth below—would be built under private auspices later in the decade. These would be between sixty and ninety feet wide at their base. To cover that space, the city would have needed to condemn large swathes of property east of Commerce and Potter Streets, which remained valuable industrial and commercial property. These rights-of-way thus provided conceptual room for a politically feasible levee but not the actual physical space necessary for building such a structure. This illustrated the larger dilemma that would dog levee proposals at the municipal level throughout the mid-nineteenth century. The public interest in excluding floodwaters from the urban landscape was clear, but the possibility of razing one block to protect the next block over proved too threatening to the residents of the region.

Rather than taking on the politically unsavory task of establishing whose property ought to be destroyed so that the neighborhood could stay dry, the city focused on using its understanding of flooding to design effective drainage practices. Petitions and remonstrances before the city council determined decisions about the development of drains and road grades. The management of competing claims about the appropriate grade of a roadway, the design of a drainage sewer, or the height of a sidewalk depended on the whims of the abutter forwarding a proposal for development before the city council. This meant that many of the basic decisions regarding the streetscape—and consequently the flow of water across the town—remained subject to annual processes of debate and revision until the establishment of the surveyor's office in 1853.[25]

The Surveyor's office provided one approach to managing land use in Hartford, but it was not the only approach. On the East Side, the centralized surveyor's office took over a position as arbiter of disputes over drainage and street design, but when it came to actual flooding, individuals remained responsible for their own adaptations. Meanwhile, Samuel Colt, the first successful manufacturer of a revolver, purchased the whole of the South Meadow section of the city and began working to transform this neighborhood into a sprawling factory surrounded with worker's housing, public parks, and other related amenities. The East Side, where the surveyor's office mediated between a multitude of property owners who worked independently to survive floods, represented the realities of water management for the majority of people in the nineteenth century. By contrast, Colt's investment in the development of the South Meadow worked on the wholesale redevelopment of the landscape in an imagined blank canvas. Studying the two approaches in parallel can contribute to our understanding of the opportunities and limitations that they both presented.

In 1854, just as Samuel Colt had begun laying dirt for his levees and the City Surveyor began mapping out the patterns of street grades, drains, and sewers on the city's East Side, three days of torrential rain caused the worst flooding in the city's history. In covering this extraordinary flood, Hartford's newspapers provided an explanation of the normal responses that they expected during ordinary floods. Comparing the ordinary with the extraordinary within this reporting provides an opportunity to understand how people lived with floodwaters, and what

25"City Surveyor," *Hartford Courant,* 1 August 1853.

challenges they faced in the course of adaptation. Residents of Hartford assumed that the worst flooding in any year occurred in the course of the thaw, and that the heavy rains bringing on the flood of 1854 occurred late enough in spring to assume that the thaw had run its course. This meant that many people living on the east side "made preparations for only a small rise of water and merely put their goods into such positions as they supposed were beyond the reach of the flood, but the water kept rising until it was too late to remove their goods, and they were submerged."[26] Families pursued a familiar adaptive practice of moving goods to high ground when faced with floodwaters, but they underestimated the volume of precipitation falling on the valley.

Between the evening of April twenty-seventh and the evening of April twenty-ninth, six inches of rain fell on Hartford and points north in the valley running up as far as Bellows Falls, Vermont. In the assessment of the *Hartford Times*, the storm consisted of a Nor'easter running hard into a storm from the southeast, that pushed the precipitation up the valley, dumping as much as a foot of snow in southern Vermont and New Hampshire while also providing more than adequate rainfall to thaw out this initial snow. In the opinion of the *Hartford Times* this flood proved more impressive because it came after the initial breakup of ice on the river and consequently it consisted of runoff from a particular storm rather than the accumulated runoff from the whole winter. In the *Times'* opinion, ice had complicated previous reports of storms because it seemed to cause flooding arbitrarily rather maintaining a correspondence between the volume of precipitation and the volume of floodwaters. Ice also threatened the accuracy of flood height measurement because historical high water marks made on the bridge were "probably

26 "Damage to Poor Families" Hartford Weekly *Times* 6 May 1854, p 2.

made from the indication upon the board upon the toll house; which cannot be accurate as the whole building was [sic] been shaken repeatedly by ice and flood."[27] The *Times* argued that a true measure of flooding would depend on both an accurate measure of flood heights, and also an acknowledgment that the severity of flooding depended as much on human interventions on the floodplain—through bridge building—as it did on the absolute measure of rainfall throughout the watershed.

While this constituted the flood with the most unambiguous potential for disaster in the city's history, the reportage covering it remained conversational and informal. Samuel Colt had just begun moving earth for his levee, anticipating a long summer building season and when the flood carried it all downstream, the *Hartford Times* quipped that his laborers "had thrown up a large pile of earth as a foundation for the dyke, but it has taken its departure for Middletown. Our friends down in that pleasant city can use it for their gardens as it is valuable top soil."[28] In tone, the *Times* freely mixed this sense of humor about flooding with an assessment of the work that the flood had undone. The process of adaptation filled most of its columns, and constituted the vast bulk of the specific information available in its coverage. Occasional references describe the severe losses visited upon the poor, who were already struggling to find adequate accommodations in a growing city facing shortages of housing for workers within walking distance of downtown factories.[29] In this sense, the *Times* showed a marked bias toward stories of

27 Ibid.

28 "Great Flood: Highest River Ever Known in the Connecticut: The Greatest Storm and Flood of the Century." *Hartford Times* 6 May 1854.

29 "The manufacturing District," *Hartford Courant* 4 September 1801; "Hartford in the Olden Times," *Hartford Courant* 24 January 1857; "Damage to Poor Families," *Hartford Times*, 6 May 1854.

resilience and adaptation in the face of flooding, only mentioning families suffering in isolation as an aside after columns of anecdotes describing flooding in more jocular terms.

The episodes of humor, resilience, and adaptation described in the *Times* depicted a commercial economy of the floodplain that possessed the resources to carry on in the face of high water. The *Times* noted the use of heavy wagons to ferry pedestrians through the flooded streets, with individual teamsters carrying as many as one hundred people per hour. About the economic costs of the flooding, the *Times* quipped that "several of our principal merchants were compelled to spend the Sabbath not inappropriately in hoisting their perishable commodities a little further heavenward."[30] At the same time, the paper presented the merchants of the town working to keep ordinary commerce going in the midst of high water, noting that one house had "200 bbls. [barrels] of beef 'afloat.' They have advertised it but those who 'call' will please take a boat."[31] It also noted that businesses including a paper maker and a brick works used the opportunity to load scows—flat bottomed boats typically used for lightering and managing cargo—directly from their shops. The organization of commerce in the midst of floodwaters reflected the skills that businesses and residents in the floodplain employed during ordinary floods and adapted to extraordinary floods.

Boat building played a large part in the adaptive process during the 1854 flood. This likely reflected an effort at managing the demands of people faced with floodwaters that rarely flowed through their streets. In the private process of adapting to floodwaters, carpenters such as Benjamin Ellis turned their shops to the construction of boats. These boats were "in some instances put together and pitched on the seams in the short space of two hours. From half a

30 "Great Flood" *Hartford Times,* 6 May 1854

31 Ibid.

dollar to two dollars an hour was freely paid for boats and rafts were in use in every section."[32] These boats contributed to the rescue of numerous people and their property as the flood passed beyond the usual bounds of adaptation, but they also served to provide a view of the flooded city for curious onlookers.

The *Times* also proved sympathetic to the animals threatened by the flood. One of the most evocative stories of the floods came from the pigsties that lined the Park river which "were 'rent asunder,' the inmates being 'boosted' in a most amusing manner to hay-lofts, and boats—the obstinate fellows squealing as loudly as possible and contending smartly against those who were striving to save their lives—or rather to prolong them for a few months for the butcher's blade and the pork barrel. Can't blame them much for preferring to be drowned."[33] By telling this story from the perspective of the animals rather than the butchers, the *Times* took on what they believed to be the active center of the drama during the flood, the skepticism that livestock expressed toward the adaptive strategies of their owners. During later floods, the presence of hogs in the floodplain would provide fodder for bigotry as the *Courant* began actively separating itself from an immigrant audience, but during the 1854 flood the *Times* took a welcoming view of the place of hogs on the floodplain. Indeed, it suggested that the community on the East Side pulled together to wrestle hogs up into hay lofts and other dry accommodations, finding amusement in "getting heavy porkers upon the second and third floors and keeping them orderly when there."

The floods also provided an opportunity for humor, particularly when it denoted a failure to adapt to flooding. The *Times* article mocked "a gentleman who desired to enjoy the prospect

32 Ibid.

33 Ibid.

'round the river,' [who] chartered a row boat with a boy to put him through. The urchin swung an uneven oar, and very soon pitched the gentleman head and heels into the muddy waters, and the next time he is caught prospecting on a flood in a row boat, he will probably dress in a bathing suit."[34] This was one of many "'duckings' from ricketty [sic] rafts and other unsteady footholds" that the *Times* mentioned, but did not cover in detail.

While the *Times* covered the floods for their humor and human interest, the *Courant* presented the flood as a public event—requiring city leadership in providing relief. Their reporting focused more on charity than mutual aid. Where individual responses to flooding fell short, city government stepped in. The *Courant* lauded the mayor and the first selectman, who "were untiring in their efforts to see that everything was done to rescue and relieve those surrounded by water. By their direction boats were constantly cruising... to rescue those in danger."[35] This dedication came despite the fact that the first selectman, Denison Morgan, lived in the floodplain at 5 Morgan Street and owned a wholesale grocery at 86 Commerce Street, directly abutting the river. The continued emphasis on the public obligations of the city's leadership indicated the degree of commitment that paper felt for running an efficient city.

In the wake of the 1854 flood, the city surveyor, William Hicks, began taking levels of street grades and mapping the city's elevations. To do this, he relied on the bridge company's data on flood heights to establish a baseline for taking elevations across the town as a whole. This data established the zero datum at thirty feet below the high water marks for the flood of 1801, could be established based upon marks kept by both the bridge company and what was

34 Ibid.

35 "Great Flood: Connecticut River Twenty-One and a Half Inches Higher than the Great Flood of 1801," *Hartford Courant,* 6 May 1854.

referred to as the ‘old distillery’ building at the intersection of Front and Talcott. Here, adaptation extended beyond merely coping with the destructive power of flooding and came to incorporate flood records into the broader land management scheme. Insofar as roadways, sidewalks, and sewers determined the course of water flowing off of the landscape and back into the river, the adoption of flood records as data guiding urban design makes intuitive sense. Moreover, the flood height data that the Hartford Bridge Company initially kept to adjudicate disagreements over their role in exacerbating flooding became incorporated into the official city record of flood heights, and this record of flood heights played an instrumental role in facilitating drainage within a community committed to adaptation rather than flood prevention.[36]

When Samuel Colt enclosed the South Meadow in a ring levee and built his firearm factory, his efforts also reflected the difficulty of establishing compromises between property owners. His approach to dealing with competition also provoked a great deal of controversy. His 1853 proposal to raise the grades of streets in the South Meadow passed through the City Council’s hands within a week and many of his neighbors complained that they did not receive an adequate opportunity to remonstrate against the improvement.[37] The property owners on the meadow had owned their land for generations and in most representations—which were admittedly produced to highlight Colt’s improvements—their agricultural productivity had apparently diminished. This only would have contributed to their reluctance to help finance Colt’s levee, which the *Courant* estimated would cost up to four hundred dollars per acre of land

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36 “City Surveyor’s Report” *Hartford Courant* 15 February 1855; the reference to the main flood marks appears in “Greatest Flood: Highest River” *Hartford Times,* 6 May 1854; For more on the old Distillery see “Hartford Fifty Years Ago” *Hartford Courant* 14 January 1857.

37 “Common Council, Last Evening” *Hartford Courant* 26 July and 2 August 1853; “Hasty Legislation” *Hartford Courant* 4 August 1853.

reclaimed. In the wake of this debate, however truncated it might have been, it is not surprising that the verse of Lydia Hunt Sigourney described him as “one who erst in his boyhood's hour/ Sported amid yon hillocks sheen/ Had vanquished the Flood whose beauty and power/ Were the pride of his native valleys green.”[38] There is an undoubted parallel between Colt’s aggressiveness in approaching city politics and his self-identification as the man who vanquished the river’s floodwaters. In overpowering his neighbors and fostering development according to his own uncompromising vision, Colt’s efforts illustrated the degree of force necessary to make levees a possibility.

Colt bought up enough land to levee in three hundred acres of property surrounding his factory, small amounts of model housing for his workers and space dedicated to further industrial development. The factory itself initially consisted of two wings measuring five hundred feet in length and sixty in width, with a one hundred and fifty foot long central corridor connecting the two wings like the cross bar of an H. By the beginning of 1861, Colt would add another two five hundred foot wings to his factory and fill in many of the intervening courtyards with outbuildings and new shops, ultimately creating a sprawling factory complex that employed 1500 people, mostly as subcontractors.[39] In the account of Elisha Root, who became the company’s president after Colt’s death, any incident stopping the machinery of the factory could cost the company as much as $25,000 per day. When manufacturing on Colt’s scale, it would be impossible to practice the types of adaptations that remained so central to the businesses on

38 Barnard, *Armsmear* p. 209

39 William N. Hosley, *Colt the Making of an American Legend* (Amherst, Mass: University of Massachusetts Press, 1996); Henry Barnard, *Armsmear: The Home, the Arm, and the Armory of Samuel Colt* (New York: Alvord, 1866).

Hartford's East Side.[40] At the same time, the availability of high-powered steam engines would prove crucial to pumping floodwaters out if the levee breached.

Colt's factories dealt with flooding by building flood control levees and employing an army of laborers to monitor and reinforce their embankments when floods occurred. The structure protected the factory from a flood greater than any witnessed in the history of Hartford, and Root described the excess capacity in the levee's height as a precaution that would protect from levels of rainfall up to a foot higher than any episode previously seen. Nevertheless, the key feature of the levee, as we will see below, was the work of maintenance and drainage that the Colt Company kept up in the face of rising floodwaters. Rather than a passive structure, the levee provided a basis for active efforts at flood control.

Perspectives on the 1859 Flood

In 1859, a pair of floods tested the levees at Colt's Armory and revealed some of the difficulties associated with the surveying of drainage and management of adaptation. Accounts of the 1859 flood describe the difficulties encountered at Colt's levee, where water seeped through the embankment, necessitating the engagement of factory employees to shore up its construction during the course of the flood. At the same time, the drains that had been surveyed and laid out so carefully by Hicks over the last five years flowed in reverse, creating new patterns of flood flows that would remain an ongoing challenge through the next decade. Colt and Hicks each faced water flowing through the ground and into the city during floods, and their problems showed the common challenge of dealing with floodwaters. Flood management was not a one

40 Ibid.

time investment in a structural solution, but the ongoing investment of time and attention to the courses that floodwaters took when spreading across the floodplain.

As a natural process, the 1859 flood consisted of two discrete peaks. The first occurred on Thursday, March seventeenth, 1859, when the breakup of the ice on the Connecticut caused the river to rise to twenty-three feet, making Commerce street literally navigable by flat bottomed scows, and even as the water levels declined to twenty one feet, the *Courant* remarked that it remained figuratively "'navigable' for two-horse or other, teams—almost its entire length, and pedestrians could go dry shod from the toll bridge to ferry street. On State St. the waves had subsided almost to Commerce, and 'things' generally began to appear above the flood, but the hopes that the end of the freshet had come were entirely quenched by fast pouring rain."[41] The paper then went on to use the telegraph communiques describing the heavy rains and the breakup of ice upriver north of Bellows Falls on March eighteenth as the cause of a second flood crest. Here, rain falling on the river, when its freshet had ended so recently that water had not yet receded below flood state caused the apprehension of a subsequent flood crest, and residents of the city proved able to predict this crest because they had access to telegraphic reports that relayed its course while flowing downstream. Residents of the floodplain began to work in an imaginative space where they could picture how a flood crest moving through the watershed would shape their neighborhood.

At the same time, the ability to predict a future flood crest did not provide all the means for describing the course that floodwaters would chart. The river ice from the river's northern reaches flowed down to the city by the twentieth and twenty-first. Reporting on this later flood

41 "The Flood" *Hartford Courant* 19 March 1859.

crest, The *Courant* noted that a northwest wind blew the river ice over the eastern riverbank, reopening the channel across the East Hartford meadows that had caused so much consternation between 1836 and 1842. By this time, approximately one hundred houses sat in this floodway and their difficulties proved significantly greater than they had even during the 1854 floods because the ice floes threatened the structural integrity of their houses. The *Courant* did not, however, indict the bridge company for their management of the causeway, noting that their dry bridge had been kept open despite the threat of high water, and remarking that the presidency of the company proved to be anything but a sinecure and the stockholders were unlikely to see profits from their investment in the bridge's improvement.[42] This was at least in part because the steamboat City of Hartford had tied up to the draw of the bridge and the current subsequently carried it downstream with the draw in tow. At the same time, across the East Side, the *Courant* reported on boats plying the streets to rescue and serve communities inundated with water, and going on to note that "the streets were lively with pigs drowned out of their habitations, and many stalwart Irishmen might be seen wading to the middle in water, driving some pet of the pig-sty to more congenial scenes."[43] The recurrence of pig keeping as fodder for stories on flooding from the 1850s reflected an increasing sense that the East Side represented a disordered space within the city at large. Historian Peter Baldwin identified a similar trend in his work covering the transformation of Downtown Hartford's urban community. He argued that the efforts at municipal improvement undertaken during the 1840s and early 1850s envisioned the

42 "The Flood" *Hartford Courant* 21 March 1859.

43 Ibid.

elevation of working people's lives, but that between the late 1850s and the 1870s, these practices turned to excluding working people from public life on Hartford's streets.[44]

This alienation had political power and it would persist through the 1860s and 1870s, but it did not necessarily represent the behavior of people who really lived on the East Side. The *Courant* did not speak for all Hartford residents. The diary of Frederick Gleason, who owned a steam mill on Ferry Street and an interest in the Steamship Parthenia described how his adaptations to floodwaters fit within his broader range of activities during the week of March twenty-first, 1859. As the water rose on 16 March 1859, he spent some time working with his employees to move his goods out of the cellar before spending the afternoon at Colt's Levee watching the workers sandbag the leaks and pump out the standing water at a sluice gate that threatened to give way. He spent the night watching the water, and measuring it hourly before attending a meeting with some of the leaders of his church to discuss the possibility of hiring a second minister. He spent the eighteenth at home with a headache, but found that he needed to return to flood duty on Saturday March nineteenth as the water began rising once more. That day he built three foot tall platforms to keep the flour and other related goods above the rising water. This work left his clothes in no state to attend the early Sunday school, and consequently as he walked to church later in the morning, he joined three of his neighbors rescuing hogs from a barn on Ferry Street. After church, he checked in on his mill and found it inundated to within an inch of the meal room floor. He moved his records out of his office, by then filled with a foot of water, but then returned home, hoping, but not knowing that the flood neared its crest. After the flood did crest on Monday night, he returned to his mill, finding the goods dry even though the

44Peter C. Baldwin, *Domesticating the Street: The Reform of Public Space in Hartford, 1850-1930* (Columbus: Ohio State University Press, 1999).

water came close to soaking them, and later guided his wife through the flooded East Side so that they could see the flood height at their old house.[45]

Gleason, a solidly middle class business owner worked with his neighbors to rescue hogs and worked with his employees to adapt his business to floodwaters. He records none of the questions about class and citizenship that excited the *Courant* and the *Times* during this flood. Instead, he participated in both adaptation and flood tourism. He assessed the integrity of Colt's levee, an activity that almost certainly drew a crowd, and toured his old familiar haunts in the East Side with his wife. At the same time, the flood did not interrupt his active participation in the life of his church, and while it certainly did not pass without some stress, he bore its pressures as well as can be expected. The East Side was not a neighborhood of helpless families victimized by flood, nor was it a homogenous poor enclave where pig sties sat hard by houses and residents lived uncivilized lives. It was a community that adapted effectively to flooding.[46]

The relationship between the business owners engaged in the industrial development of the East Side and the immigrant families who lived and worked in the neighborhood likely sat somewhere between Gleason's neighborliness and the *Courant's* judgments. The neighborhood itself likely leaned toward Gleason's standpoint, but the *Courant* wrote for families living in ethnically homogenous neighborhoods farther west in Hartford.[47] Beyond the city limits, the numerous farming communities surrounding Hartford likely remained suspicious of the city's rapid urbanization. This range of views comes through in the *Courant,* as During the 1860s the

45 Frederick Gleason, Diary, 16-22 March 1859, CHS.

46 Ibid.

47 These houses are now maintained as tourist attractions by the Harriet Beecher Stow Center, harrietbeecherstowecenter.org.

judgments passed in flood coverage fluctuated inversely with the level of detail brought to reporting. Particularly dramatic floods produced some of the best descriptions of a community adapting to adverse circumstances, while more mild flood events resulted in vague references to the evacuation of Pigville, as the East Side was sometimes called.[48]

The tensions between broad based middle class apprehensions and the adjustments that characterized local communities can be seen in contrasting elements of the *Courant's* coverage of floods during April 1861 and 1862. The *Courant* relegated the 1861 flood to a news brief. The spring flood reached twenty-one feet, leading the courant to observe that "Pigville is surrounded, the East Hartford flats are covered, the stores on the riverfront are getting a rinsing, and Commerce Street at its crossing with State, is submerged."[49] This account summarized a flood that undoubtedly necessitated some degree of adaptation, but did not provide enough grist for an in depth story. By contrast, the *Courant's* concern for the 1862 flood began on April nineteenth, with the river at twenty feet, but news of significant flooding in Brattleboro, Vermont and Springfield, Massachusetts indicating that it would continue to rise for several days. Ultimately, this flood reached twenty-seven feet a height that prompted a broad panorama of adaptations. One thousand laborers lined up behind Colt's levee to shore up any breaches, a labor force that emphasized the provisional character of even the most substantial levees. On the East Side, "rafts and boats were darting about, a fleet of dirty gondolas in a very dirty Venice, with gondoliers not the most musical in the world, though their gaity [sic] and festivity has seldom been surpassed."[50]

48 "The Situation in Pigville" *Hartford Courant* 20 March 1865.

49"The River" *Hartford Courant* 16 April 1861

50"The Great Freshet: The River District Submerged: Railroad Travel Interrupted" *Hartford Courant* 21 April 1862; the first report on the flood appeared in "Great Freshet" ibid. 19 April 1862.

Water ran across the East Hartford Meadows in a continuous sheet and East Hartford residents entertained fear that the high water would interfere with the operation of the waterworks and the gasworks. In these accounts, the main fear associated with flooding concerned its potential to interrupt water and gas service to houses outside of the floodplain, while the paper treated the work of living with floodwaters as a dramatic but momentary challenge.

As the flood unfolded, a series of stories provided more in depth accounts of how people adapted to flooding. On April twenty-first, a fire spread across half a dozen businesses from a shop at Front and Morgan. Rather than the 'dirty gondolas of dirty gondoliers,' the skiffs that the fire department borrowed to run their hose lines to the building became "the smaller navigational property of the community." At the same time, the course of the fire through the floodwaters brought many businesses' adaptive practices out of their attics and into the public eye. The Grocer William Willard had stored his goods in Rockwell's attic. The manufacturer Beach and Company had stored many of their materials in the building of Beckwith and Tyler, also losing many of these goods when that store burnt. As the reporter observed, the prudence of relying on neighbors for the storage of goods vulnerable to flooding was doubly undone by both fire and the invalidation of insurance coverage for goods moved out of the original shop. The details of potential insurance claims notwithstanding, this fire provided a window into the systems of mutual aid between shopkeepers and factory owners that made it possible to survive flooding.[51]

Households disrupted by the flood generally prioritized sheltering in place, with many families staying in the upper floors of otherwise inundated buildings and depending on the regular visits from neighbors and concerned citizens piloting boats through the neighborhood.

51 "Fire and Water" ibid. 22 April 1862.

Despite their clearly straightened circumstances, the reports suggest that they met the floodwaters with good humor. Indeed, a report from April twenty-second discussed rowing through the neighborhood with a man named Darius Crosby in a dismasted sailboat. In this trip through the neighborhood, the author noted that the "common salutation to visitors was 'sail in' and every house had open windows to facilitate the operation." Once inside, he found that "the furniture was found in every position but one of comfort. The people took it all kindly, however, and were willing to return a jest, although under the circumstances dry jokes were impossible."[52] The story went on to describe the evacuation of tenements facing the most severe flood damage and the proliferation of boats in such numbers that collisions were to be expected, but overall this report on flooding incorporated a great deal of detail on the nature of community responses to inundation.

As noted above, the *Courant's* use of the telegraph to provide an advance flood estimate proved key in changing perspectives on the floods of the 1850s and 1860s, and perhaps they actually played a key role in transforming flooding into an object of developing journalistic attention rather than retrospective assessment. The availability of telegraphic news also appears to have changed how residents of Hartford thought about flooding. In the wake of the 1862 flood, Henry Bradford, a resident of Front Street, wrote to the editor of the *Courant* to argue in favor of the construction of a levee.[53] He noted the success of Colt's levee and pointed to a future where increasing demand for lumber from the Upper Connecticut—which the Connecticut Valley Lumber Company had just begun to exploit on the order of tens of millions of board feet per year—would lead to massive erosion and an increasingly severe spring freshet. Historical studies of

52 "The Freshet" ibid. 22 April 1862.

53 Henry Bradford, Letter to the Editor, ibid. 23 April 1862.

the Upper Connecticut Valley have suggested that clearance had actually been greater during the 1830s and 1840s, but nevertheless, the perception of deforestation as a driving force in the increasing severity of flooding actually became a matter of public concern in the immediate wake of regional flood assessments facilitated by telegraphy.[54]

The potential, but also the limitations of telegraphy as a means of preparing for the floods came through in the *Courant's* coverage to two floods in 1869. The paper initially reported on the spring freshet a week before its arrival in Hartford as a storm ranging through upstate New York, the Saint Lawrence River Valley in Quebec, and the Upper Connecticut in the vicinity of Wells River and White River Junction, Vermont. newspaper reports of these floods foreshadowed the flow of water downstream, and when this flood crest reached Hartford during the next week, the residents of the East Side proved well prepared to handle flooding above twenty five feet.[55] By contrast, the October 1869 flood resulted from a tropical storm sweeping up the valley, and the winds and rain from this event downed telegraph poles and made it difficult to communicate the nature of flood damage across the valley. Meanwhile, the flooding caused by tropical storms resulted from the cumulative flow of numerous tributaries overflowing with between five and eight inches of rain. The roughly instantaneous runoff of this accumulation meant that floodwaters approached Hartford quickly rather than meandering slowly through the valley as they did during the spring freshet.

Residents of the East Side understood flooding as a product of precipitation across the Connecticut Valley as a watershed and they used the ongoing improvements in communication to

54 William Gove, *Log Drives on the Connecticut* River (Littleton, NH: Bondcliff Books, 2003); Ronald M. Harper, “Changes in Forest Area of New England in Three Centuries” *Journal of Forestry* 16 no. 4 (1918) 438-52.

55 "The Spring Floods" *Hartford Courant* 30 April 1869; "Fall Flood" Idem., 5 October 1869.

improve their adaptive strategies for dealing with floodwaters. Moreover, the community ties within the East Side, which enabled businesses affected by floodwaters to store goods in their neighbors shops or take refuge in a neighbor's house, provided a means of dealing with the difficulties of living with floodwaters in Hartford. Indeed, in the minds of newspaper reporters, and likely many observers living off of the floodplain, the main concern associated with flooding resulted from its threat to public forms of infrastructure such as the gasworks or water lines. Even within the East Side, reporters focused much of their column space to the drainage backups that necessitated the removal of pigs from their sties. While strong community ties certainly fostered adaptation within the East Side, the city at large paid little attention to the possibility of public interventions against flooding as a problem besetting the neighborhood. Ultimately, a flooded house might be a tragedy, but only the interruption of gas service to that house would constitute a public problem.

Levees after Colt

The argument for a levee changed during the 1860s. Samuel Colt died in 1862 and his political alliance with the working men of the East Side disappeared. This transformed the discussions of how the South Meadow related to the East Side. The replacement of the mercurial Colt with his wife Elizabeth Hart Colt, and his chief engineer Elisha Root made the Firearm Company a more amenable neighbor to the remainder of the city. Their administration proved effective in steering the company through the difficulties associated with Colt's death, a devastating 1865 fire in the armory, and then Root's death in September 1865. Schadenfreude might have made it easier for the city's leadership to sympathize with Elizabeth Colt, but her patronage of the Episcopalian Church, the Wadsworth Atheneum, and the Hartford Soldiers Aid

Society certainly also endeared her to the community. While many things went wrong for the Colt Firearm Company during the 1860s their factory continued to grow success tempered by adversity helped to integrate the factory within the community.[56] Consequently flood reporting covering Colt's levee became more sympathetic and controversies over the development of infrastructure that connected the South Meadow to the East Side and downtown could be overcome.[57]

In 1868, the city investigated the possibility of building a levee on the East Side to match Colt's structure. When they took the issue on, the city turned to W. B. Franklin, superintendent of Colt Firearms to assist in surveying the proposed levee. Ultimately, this embankment went unbuilt, but the debates over flood control in the neighborhood provided insight into how people understood the problem of flooding. The idea of flood control development grew far more complex between 1852 and 1867, paying more attention to groundwater and drainage. Groundwater reflected an ongoing worry about how flood control might ultimately fail if it proceeded simply by the construction of levees. Instead, the commission charged with investigating a levee system recognized that flood control reflected an ongoing and uncertain investment and that gave them pause when considering whether to recommend the plan to the City Council. In this way, questions about groundwater flows and sewage posed the greatest challenges to levee building.

It is perhaps unsurprising that the question of flooding in the Connecticut Valley turned on debates about drainage.[58] The focus on sewers reflected the success of the city surveyor's office in improving the everyday drainage of the East Side and helping to eliminate nuisances

56 Hosley, *Colt*.

57Barnard, *Armsmear* p. 238-262.

relating to the keeping of hogs in this neighborhood. While this improved the quality of life during the fifty one weeks of the year that typically surrounded the freshet, it also resulted in backwater during floods. In the spring freshets of 1862 and 1865 backwater ran up through sewers and into the hog pens surrounding the Park River, even reaching far above the low lying floodplains of the East Side.[59] The proposed construction of a levee would also have made the disposal of sewage in the Connecticut more difficult. Managing the drainage of storm water and human waste from the low lying areas of the city, which could potentially sit below the waterline after the construction of the levee threatened to turn the East Side into a particularly turbid swimming pool. To solve this problem, Laurie and Franklin's report considered the feasibility of constructing a pumping plant that could clear wastewater and improve conditions and proposed setting aside a drainage pond that would collect the runoff of the floods. Ultimately, these would be the main challenges to dealing with floodwaters.

In considering their proposal, the city's engineers considered the possibility that groundwater infiltration through the filled land on the banks of the Connecticut might undermine any dike. Their concern, like so many of the concerns about setting the course of the river, came down to questions of floodplain geology. One of the engineers in the study, James Laurie, cautioned that "the map of the city as late as 1824 shows Meadow Creek running inland about 250 feet from the line of the river to the foot of Kilbourn Street; while from Ferry Street to near Dutch Point the line of the river is near the present site of Commerce Street. Much of this made ground probably consists of debris and refuse from the city and cannot be relied on to form a

58James Laurie et al., *Report of the Committee on the Proposed Hartford Dyke* (Hartford, Ct: Wiley, Waterman & Easton, 1867).

59“The Freshet: Heavy Flood Anticipated” *Hartford Courant* 22 April 1865; “The Freshet” ibid., 18 March 1862 both describe sewer backflow as a cause of flooding.

water-tight barrier."[60] Local thinking on this issue would become clearer in reporting on the Fall 1869 flood, where the police began warning businessmen that their shops were flooding as the water percolated into their basements hours before the water reached street level. Residents of the East Side reiterated this perspective during the 1895 flood, when reporters noted that they judged risks based upon the amount of groundwater percolating into their basements in addition to whatever awareness they had about the height of the river itself.[61] This reflected a local knowledge of flow dynamics at least as sophisticated as the commentaries on how geology would effect efforts at reshaping the Westfield River, discussed in chapter two. Laurie went on to discuss concerns about the percolation of groundwater under Colt's embankment during floods and the clear effects of river height on the groundwater seeping into the basements and wells on Mechanic, Ferry, Commerce, Kilbourn, Pleasant, and Front Streets. Drainage flowed both into and out of the river. This added to the complexity of levee proposals, expanding them beyond the passive mounds of earth walling out the water to incorporate pumping stations and retention ponds.[62]

The successful adaptation of east side households and businesses to flooding encouraged thrift in levee design. The levee proposal included a section that incorporated the walls of existing buildings into its structure. "At the old block of buildings near the foot of Ferry Street, it [was] proposed to pass the embankment through and to fill up solid the interior of the south end, cut by the embankment.. . to about the height of the second floor. The building will not have to

60*Report of the Committee on the Proposed Hartford Dyke*, 21.

61"River Rising Rapidly: Hartford's Annual Spring Flood Has Begun," *Hartford Courant*, 11 April 1895.

62"Overflowing of the Connecticut" *Hartford Courant* 26 April 1852.

be removed."[63] The integration of public and private property in the proposed levee undoubtedly came about as a means of saving condemnation costs and preventing the complete displacement of individual property owners. This sensitivity would give rise to the contention that the levee would only benefit the private interests of a small group of property owners.

Remembering that Colt's employees stood poised to reinforce the levees during high floods, it seems clear that flood control projects did not signify a one time investment in a set piece of infrastructure, but rather an ongoing obligation to pump waters from the levee-ward side and reinforce its structure during floods. Because of this criticism, and an understanding that levees would constitute an ongoing work obligation rather than a one-time expense, the levee would go unbuilt during the 1860s and '70s and instead the city would encourage property owners to raise their buildings above the floodplain. Like the sewers that played such an important role in an individually oriented adaptation similar to their continuing efforts to protect personal property from flood damage.

Between April twenty-third 1869 and April twenty-second 1870 Hartford would experience six floods. The first and last of these crests would be consistent with a late spring freshet. Add to these storms two floods in October 1869 as tropical storms ran through the valley, and smaller ice jam floods in January and February 1870 and it becomes clear that this year was extremely hydrologically active. Interestingly, the April 1869 crest would measure five inches higher than the first October 1869 crest, even though coverage of that later crest would prove much more dramatic.[64] In the *Courant's* report from 5 October, they printed a telegraph message from Littleton, New Hampshire warning them to “look out for a terrible freshet. We had it last

63*Report of the Committee on the Proposed Hartford Dyke*, 36.

64“The Flood Subsiding” *Hartford Courant* 22 April 1870.

night. Notify the bottom lands."[65] The *Courant* replied that Littleton was far upstream—about two hundred miles away by boat—and if "we are yet to get its drainage, Hartford might as well move out of the state." The telegraph from upstream might have been an effective means of warning about the spring freshet, which moved downstream relatively gradually, but it provided little protection from the faster runoff of a rainstorm, particularly one measuring in the range of five to eight inches in thirty six hours.

Despite the differing cause of the flooding, the *Courant* observed that "the scenes which annually recur with the spring freshet season, in the lower wards of the city, were reenacted yesterday." Families relocated to the upper floors of their houses, boats plied Commerce Street and the surrounding ways, and often pigs kept in ground level sties required relocation to the upper floors of houses. If the October storm differed from the slow thaw of the spring freshet in any way, it was that the city proved less able to anticipate its rise. Much of the response to the October flood focused on the necessity of abrupt adaptation. Debris from the rising water clogged the sewer lines draining the pig sties along Railroad Row, a bank of houses on the river side of the railroad tracks in the North Meadow, prompting their hurried evacuation. By contrast, the higher flood that had occurred during the spring did not result in anywhere near as much notable destruction, a fact that likely resulted from the better communication of and preparation for flooding during that season.

A year with six floods coming close on the heels of a rejected levee proposal gave renewed energy to the search for solutions to flooding. In April, 1870, a letter writer to the *Courant* tried to revive the argument that a levee would provide a general public benefit rather

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65"Further Particulars of the Great Storm" *Hartford Courant* 6 October 1869.

than merely accruing benefits to the private landowners in the floodplain. This argument centered on how a levee would facilitate the improvement of wharfage for the city and potentially reduce the cost of goods being shipped into the city by a dollar per ton. Like the 1852 levee proposal, this suggestion went nowhere, but the idea of developing a levee persisted.

While the city could not muster the political power to build levees and separate the East Side from the floodwaters, a railroad could. The Connecticut Valley Railroad sold its stock to the City of Hartford as a combination levee building scheme and transportation improvement. This road would provide an economic boost by connecting the city directly with the upper valley, but more importantly, residents of the city envisioned its potential as a private means of constructing a flood control levee.[66] This vision depended, however, on routing the railroad through the East Side. The actual route remained up for debate between 1868 and 1873. Constructing a railroad through either the eastern or the western neighborhoods of the city could have dramatically different hydrological and social consequences. The West Side route left flooding roughly as it was. The East Side route entailed clearing blocks of slums, and raising an embankment that enabled the road to run at an acceptable grade between Colt's levee and their proposed freight depot north of State Street. In addition to accessing Colt's levee, the railroad's promoters argued that it would keep the trains running throughout the year rather than leaving their operations up to the vagaries of floodwaters.

Debates over the railroad's route concerned flooding, but did not explicitly address flood control, because while flooding might not have been a public enough issue for a government-

66 "The Freshet Nuisance: Its Effect on the Prosperity of Hartford" *Hartford Courant*, 27 April 1870; "An Act Incorporating the Connecticut Valley Railroad" passed 17 July 1868, Connecticut Private Acts and Resolutions May Session (1868); "Amending the Charter for the Connecticut Valley Railroad" Passed 29 July 1868, Ibid. 406.

funded levee, it also was not an issue that this particular private corporation was intended to tackle. Much like the proposed Northampton and Springfield Railroad in Hockanum, the role of the Connecticut Valley Railroad in helping to control floods was intended to be an adjunct to their broader goal of providing reliable, regularly scheduled service. The ability of railroad time to supersede seasonal forms of time by intervening upon the landscape existed more in the fond hopes of cities promoting their development than they did in the explicit business plans of railroad executives.

Meetings of the railroad's directors and hearings before the Connecticut Railroad Commission, debated the route on merits unconnected with the potential for an embankment to act as a levee. The directors were concerned about whether the center of business in the town was moving westward, and whether developing connections between riverboats and the railroad could benefit the town. These questions appeared in tandem with two questions about the environmental impact of the East Side route. The first being whether the sandy soil of the riverbank, could hold the weight of a railroad embankment?[67] The second being whether building a depot along the river would necessitate the keeping of a ferry to lead passengers to dry land during freshets?[68] At the same time, the *Courant* speculated that rumors about the difficulty of running railroad tracks along the floodplain and the consequent benefits of the West Side route could be a mere ploy to increase the sale of capital stock to the proponents of the East Side route.[69] This effectively happened during a meeting of the directors on November eighteenth

67"The Valley Railroad Embankment" *Hartford Courant* 12 September 1870; "The Railroad War" Ibid. 7 November 1870.

68James Batterson and Henry Deming quoted in "The Railroad Hearing" *Hartford Courant* 14 December 1870.

69"The Valley Railroad: Street Rumors" *Hartford Courant* 24 September 1870.

1870. Two of the directors who had played an instrumental role in surveying the West Side route resigned, a vote was taken to approve the East Side route, running along Commerce Street to Ferry Street, stopping at the Bridge causeway, and supporters of that route pledged an additional twenty five hundred dollars in stock purchases.[70]

The *Courant* celebrated the development of the railroad through the East Side, however, the potential for this route came into focus. The Connecticut Valley Railroad was removing slums and raising the grade of Commerce Street. The *Courant* lauded the changed scene on Commerce street, with its old rookeries and forbidding sights generally, has been completely wiped out, leaving nothing scarcely for the oldest inhabitant to recognize as a familiar landmark."[71] The reporter imagined that these tracks, because they destroyed many of the old warehouses and barns along Commerce Street, would help to make the neighborhood a vibrant point for trade and industry once more. At the same time, we might imagine that the effort at raising floodplain land above the waterline would remove many of the temporal cues that had once defined the floodplain landscape. No more would the percolation of groundwater seeping into basements signal the rising of the river and the beginning of the freshet. No more would the spring floods prompt the hasty evacuation of tenements, shops and mills. These events would form part of a larger transformation, where the tenements themselves disappeared and the mills transformed from small shops to factories on the scale of Colt's Armory, willing to invest in massive earthworks to prevent the interruption of production. Burying a floodplain under a fresh layer of earth would mean an end to thinking like a floodplain. It would entail resetting the

70“The Valley Road: A Reconsideration by Directors: East Route Adopted” *Hartford Courant* 18 November 1870.

71 “Riverfront Railroad Progress” *Hartford Courant* 31 March 1871; “The Valley Road and the Dyke” Ibid. 18 November 1871;

tempo of everyday life away from the rhythms of seasonal changes in the flow of water and building a landscape that the town's oldest inhabitant would scarcely recognize.

Like so many development plans, the *Courant's* vision for the East Side never came to be. The embankment and the levee rose up along Commerce Street, but the remainder of the neighborhood remained a floodplain, adjusting itself to the high water throughout the remainder of the nineteenth century. Only in 1909 would the city build a full-scale levee with pumps and reinforcement that could actually keep out most floodwaters. This project, dramatic though it was, came at the cost of destroying most of the East Side neighborhood and building a roadway in its place. Once again, the city proved amenable to building transportation infrastructure that could deal with flooding, but unwilling to help existing neighborhoods adapt to flooding.

Conclusion

Between 1836 and 1870, the city of Hartford underwent a number of dramatic changes. It became a center of manufacturing with a significant immigrant community and the beginnings of suburbs. Colt and the Connecticut Valley Railroad each gained ground against the river, transforming Hartford's floodplain into two landscapes, one flood-free and intensively drained and the other intermittently inundated and haphazardly drained. It might be said that the levee builders in Hartford pulled themselves into a new, contained watershed, and came to control the flow of water within those bounds.

The development of control over water in a bounded space contributed to the development of a new temporality in the Connecticut Valley. Seasonal variation in the flow of water did not interrupt production and geological processes reshaping the landscape became a matter for experts, not individual residents. For communities that thought of the flow of water and the passage of time as interconnected processes, this marked a dramatic break. The first chapter of this dissertation explored how the flow of water provided a heuristic means of identifying seasonal change, and this chapter mirrored that one by exploring the continuities joining the rural sense of water's changing seasonal flow with the dynamics of urbanization in the city of Hartford. In both city and country, practices guiding life with high water remained stable even as the infrastructure of water use and transportation underwent dramatic transformations.

Changing attitudes toward flooding did not result from complaints originating in the floodplain. In part, this reflected the ways of thinking about floodwaters, and the flow of water more generally, in the Hartford region. Communities thought about flooding as a seasonal event that followed from the thaw or a heavy rain. Its sheer regularity and the common practices for adapting to floodwaters revealed important ties and rivalries within the towns, but the very forms of community solidarity in the face of flooding might have been an obstacle to the mitigation of flooding. Advocates for flood control projects lacked the urgency that they might have possessed in a community less able to deal with floodwaters. Indeed, the very objects of flood protection in mid-nineteenth-century Hartford—the bridge, Colt's factory, and the Connecticut Valley Railroad—operated on a scale that would have been impossible to protect from flooding.

Perhaps more importantly for the purposes of this study, the structures that received the greatest attention with regards to flood control were all expected to operate on schedules that existed independent of seasonal time. Colt's factory lost $25,000 per day when it shut down, the railroad operated on a fixed timetable independent of the weather, and the bridge faced continual pressure to demonstrate that its operations existed in the public interest and could be maintained in the face of any hazard. Each of these structures served communities beyond the floodplain and consequently were driven to answer demands occurring independent of the seasonal variations in the river's flow. They operated on clock time. As such, they each needed to intervene actively in modifying the landscape of the floodplain in order to detach their own sites of operation from the vagaries of seasonal time.

Conclusion: Who Went with the Flow?

...Admit that the waters
Around you have grown,
And accept it that soon
You'll be drenched to the bone.
If your time to you is worth savin.'
Then you better start swimmin' or you'll sink like a stone
For the times they are a-changin.[1]

Thinking like a floodplain entailed identifying old river channels traced in the silt, anticipating freeze-thaw cycles, and understanding how these patterns added up to flooding in high water. The floodplain shifted slowly over the long term, laying silt incrementally to bury whole trees, but it also scoffed at the idea of permanence. Bridges, dams, roads, and even fields faced regular inundation – to say nothing of the neighborhoods on Hartford's East Side where renters headed for the garrets when they saw the water rise in spring. Living along the floodplain meant thinking like a floodplain and surviving without pretending to control the river indicated clarity of thought. Thinking like a floodplain entailed pacing work to dodge and roll with a river whose flows remained out of control. It meant knowing history and being able to recall how high the freshets had run, where the old river channels sat, and how to tell a forward spring from an ephemeral thaw.

Thinking unlike a floodplain meant cutting out enclaves of water management independent of the river's varying flow. To think unlike a floodplain entailed avoiding the consequences of seasonality, arrogating the privilege of building permanently within a stream, and working to contain and distribute water based on its quantity rather than adjusting to its flow

1 Bob Dylan, "The Times They Are A-Changin'" *The Times, They are A-Changin'* (Columbia Records, 1963) lyrics printed at http://bobdylan.com/songs/times-they-are-changin/

across the landscape. Thinking unlike a floodplain meant hardening the banks of the Connecticut at Hockanum rather than adjusting to a new pattern of erosion, installing water meters in Holyoke factories rather than measuring their water in terms of factory design. elevating the tracks of the Connecticut Valley railroad on Hartford's East Side rather than finding a way to operate despite floodwaters. In many cases, these acts reflected instances where corporations cut out islands of water management that made them seem independent of erosion and seasonal variations in the river's flow amidst a valley where ordinary communities continued live lives adapted to the flow of an uncontrolled river. The existence of corporate control over the flow of water somewhere did not mean the death of the river everywhere. Nevertheless, the communities in the lower valley paid increasing attention to how they could push the boundaries of seasonal change and control the river's flow after 1870. To cast light on this contrast, the conclusion reviews how valley communities historicized the river's flow between 1790 and 1870 before briefly noting the questions that this work raises for our present understanding of rivers, the flow of time, and history.

The Times They Were a-Changin'

Reviewing the act of thinking like a floodplain raises two questions, one historiographical and answerable and the other philosophical and ruminative. The historiographical question concerns how we ought to situate the confluence of thought in natural history and historical memory in the politics of the Connecticut Valley relative to questions about temporality current in the field of history writ large. The philosophical issue, arising from this historiographical line of inquiry, concerns a network of questions that arise in the twenty-first as we come to an understanding of how people 'thought like a floodplain' in the early nineteenth-century

Connecticut River Valley. This work's methodology and content do speak to questions about how people have thought historically and in this sense it touches on a broader question about how people ought to think historically. When we focus in on how timescales interacted in the course of the nineteenth-century valley, it raises the question of how societies develop their sense of temporality and what forms these temporalities take within different geographical contexts. Rather than suggesting that "a spectre is haunting our time, the spectre of the short term" I would be more inclined to suggest that people make their own temporalities, but they do not make them just as they please; they do not make them under circumstances chosen by themselves.[2]

Residents of the nineteenth-century Connecticut Valley did not make the conscious decision to start thinking like a floodplain. Seasonality and geology constituted a presence in early nineteenth century ways of reading the landscape because they provided a means of fitting the work of everyday life within the possible extremes of the river's flow. In weather diaries, the flow of water provided a heuristic tool for knowing when to carry out which forms of work upon the landscape. At the same time, it also tolled reminders of the work necessary to keep the flow of water within the bounds of normal water use. Water provided the key connection between the weather and the landscape, providing the evidence of seasonal changes that made it possible to time labor in accordance with water's presence or absence. In the forms of farming taking place along the floodplain during the course of the nineteenth century, water defined the process of seasonal change upon the landscape while seasonal changes in the weather—temperature and precipitation—defined the presence of water. Beyond this reasoning, admittedly circular because

2 David Armitage and Jo Guldi, *The History Manifesto* (Cambridge: Cambridge University Press, 2014) p. 1; the alternative formulation paraphrases Karl Marx, *The Eighteenth Brumaire of Louis Napoleon* (London: Elecbook Classics, 2001) p. 7.

it reflected important feedbacks in the natural world and in how communities managed the landscape, the seasonal patterns in the flow of water observable in these diaries reflected a broader understanding that the Connecticut River Valley did not constitute a singular landscape. It constituted four different landscapes that varied based upon the seasons, and whose changes needed to be taken into account when engaging in water management activities.

Attention to seasonality and geology proved effective sources of knowledge when protesting water engineering. The rhythms of seasonal change that defined the Connecticut landscape shaped the scope and limitations of the South Hadley Canal. Variations and extremes in the flow of water created limits for canals while also setting a boundary on the intensity of river management activities during the early part of the nineteenth century. Residents of the Connecticut Valley understood that where water flowed across the landscape in the present was not where the water had flowed in the past, and that accounting for variations in the water's course should also shape how communities made decisions about water management more broadly. Geology and seasonal change provided paired rubrics for judging what forms of water management ought to be feasible in the early nineteenth-century valley, and many farming communities consciously structured their working habits in line with these broader temporal rhythms of landscape change, making the disruptions of seasonality by water power installations a powerful problem.

Seasonality and geology framed protests that set limits on how the navigational canal at South Hadley Falls could transform the landscape. The limitations on water management forced the canal's owners to reckon with difficult choices between modifying the geology of the riverbed and changing the pace of seasonal change on the landscape for upstream communities.

In making these choices, the canal company narrowed the scope of their intervention in the river—limiting themselves to the modification of a short reach below the towns of Northampton and Hadley—and integrated themselves within the expectations about the timing of water's flow that governed the river at large.

To say that the canal company integrated themselves within the community is not to say that they ingratiated themselves to the community. They built and maintained a dam across the river, but they also faced a string of law suits that maintained a historical memory of the early problems that they caused within the valley, and threatened to prevent the rebuilding of their dam after it washed out in a string of freshets. In this sense, the experience of the South Hadley Canal reflected how seasonality and geology coexisted within a matrix of historical memory about the flow of water, but also the contrasting timescales at work in thinking about the canal and thinking about the lives of farmers upstream. The dam proved anything but permanent and its impermanence made the problem of water management at the canal an ongoing one rather than making its legal victories permanent victories.

Memories of past water use also provided a means for dividing industrial water. They describe a world beyond the protests of aggrieved farmers searching for justice against corporations and bring our focus to the networks of community memory that defined water use at sites covered by ancient mill rights. Refocusing the development of water on the gradual adaptation of these ancient sites—rather than the creation of new industrial towns at relatively empty fall lines—illustrated the different strategies for production, and water rights management, that prevailed across much of New England. In the Connecticut Valley, the work of industrialization preceded through the reappropriation of historical water power practices rather than the quantification and division of water within the region.

The challenge of integrating disparate water resources in the region meant that centralized water management systems proved the exception rather than the rule. The Holyoke Water Power Company gained control over a volume of water sufficient for its commodification by working within the limits of the hydrological connections joining South Hadley Falls with the Northampton Meadows. Indeed, the success of their initial reservoir depended on the fragmentation of these two adjacent and hydrologically interconnected reaches on the river. Nevertheless, their approach to managing the flow of the Connecticut contributed to the beginnings of watershed thinking because they paid close attention to the quantification of water and the maximum regular flows that they could promise to factories locating along their canals. By regularizing the flow of water, making sure that it passed through factories at an even tempo independent of the seasons, the Holyoke Water Power Company contributed to making the riverine landscape unlike a floodplain.

At the same time, the work of putting together flood control systems depended on the centralization of resources and the exceptional exercise of power. The challenges underlying flood control development did not begin with the experience of floodwaters and end with the construction of levees in a linear project. Instead, efforts at mitigating floods awaited the development of temporally situated demands for floodplain land use. Colt needed a levee because of the expenses incurred when his factory went offline. The Connecticut Valley Railroad needed an elevated causeway because it would help them pass unharmed through floodwaters. The infrastructure of flood control was also an infrastructure for controlling seasonal time and mitigating the challenges associated with geological processes such as erosion and groundwater percolation.

The sense of time that dominated the valley into early industrialization differed fundamentally from the sense of time that informed landscape changes as industrial development intensified. As work became a steady process where idle factories meant idle capital and the difficulties associated with the seasonal disruption of the landscape threatened daily life, responsibility for the challenges posed by seasonality and geology shifted from the public at large to specialized groups of engineers and managers who could regularize the flow of water, walling out the floods and quantifying the inflows for power generation and processing. People learned to think unlike a floodplain in their everyday lives because engineers and water managers stepped in to manage water on their behalf.

This suggests that the appropriate question in tackling temporality does not concern the decisions of historians working to foster the development of a new historical consciousness or hectoring the public to engage with history in new ways. Instead, historians may want to reflect on how the organization of society has shaped temporality. The water management practices that communities in the Connecticut Valley fought for in the nineteenth century grew out of ordinary working practices in the region and they grew from there to shape public knowledge of geology and the administration of water law and policy within the region.

Epilogue: Water Management After the 1870s

Most of the time, most communities in the Lower Connecticut Valley worked with water whose flow remained beyond their control. They paid attention to the patterns that these flows showed during seasonal changes, the patterns that the river cut into the ground through the meandering process of erosion, and they used a variety of strategies for remembering and learning from their historical experiences with the river's flow. These strategies survived into the 1870s as the modification of the river's flow became an increasingly common and viable way of thinking about water management. The story of the valley between the 1870s and the 1930s became radically different from the story that existed in the Early Republic.

New technologies for pulping wood and making paper intensified logging in the upper valley. During the 1850s, log runs traveled downstream in rafts that looked much like they had since the 1790s.[3] Upstream loggers lashed together their timber in rafts referred to as boxes, and then sent downstream in divisions of rafts that could easily add up to several hundred thousand board-feet. Like the canal at South Hadley Falls, ongoing maintenance problems beset upstream canals at Quechee, Olcott, Bellows, Millers, and Turners Falls. One log raft cook noted ruefully that when they approached Olcott Falls in 1850, "the locks were put in operation, five boxes went through, when they were going through with the last one the wall fell in onto one end of it."[4] When the boatmen finished repairing the locks two days later, they found that the sand running off of the bank and through the canal had silted up the river immediately below, making it necessary to run a plow through the shallows below the locks so as to deepen the channel. The lack of regular maintenance at canals contributed to navigational problems up and down the river during the 1850s, and this made it difficult to continue running log rafts.

In New England more generally, the division of logs into rafts and the loading of these rafts with forest products and farm goods for sale downstream was already something of an

3 Jedediah Morse, *The American Universal Geography, Or, A View of the Present State of All the Empires, Kingdoms, States, and Republicks in the Known World, and of the United States of America in Particular* (Boston: Printed by J.T. Buckingham, for Thomas & Andrews, 1804).

4 Alonzo Niles, Diary, typescript held by Brattleboro Public Library, Brattleboro, VT.

anachronism by the 1850s. The log runs on the Penobscot River through Bangor, Maine had consisted of loose logs running down stream and managed by the controlled release of water from artificial reservoirs since the 1830s.[5] The Connecticut River could only copy this pattern when corporations formed that could recruit experienced log drivers and managers while increasing the scale of upstream timber operations from local clearances to corporate sawmills. Until the establishment of large-scale sawmills in Holyoke, Easthampton, and Hartford, it would have made little sense to run millions of board feet of loose logs downstream, but with this infrastructure in place, log drives running millions of board feet of timber down the Connecticut became a regular sight.

The first such run—organized in 1869 at the behest of downstream saw mills—went clear through the South Hadley Canal to Hartford. By 1879, however, the Connecticut River Lumber Company was working to consolidate its holdings in upstream timber and downstream sawmill capacity.[6] The sawmill at Holyoke, Massachusetts was located well above the dam along a series of islands that had formed as the dam backed up water onto the banks of the river. A boom strung through the straits formed by the Island and the mainland provided the primary means of storing logs before taking them into the mill, but this space provided could hardly be expected to hold an industrial quantity of lumber measuring in the millions of board feet. Consequently, the Holyoke Lumber Company, and its successors, the Connecticut River Lumber Company and the Connecticut Valley Lumber Company began seeking out alternative spaces for storing lumber in the valley. Their most fruitful spot turned out to be the old oxbow, and numerous photographic

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5 Richard G. Wood, *A History of Lumbering in Maine, 1820-1861*, University of Maine Studies. Second Series, no. 33 (Orono, Me: University of Maine Press, 1935) p. 110-127.

6 Philip Gove, *Log Drives on the Connecticut River* (Littleton, NH: Bondcliff Books, 2003)

postcards from the late nineteenth century attest to this fact. Cole's view of the bucolic landscape from Mount Holyoke stood alongside the evidence of industrial development in the esteem of tourists during the second half of the nineteenth century.[7]

7 "Logging at the Oxbow on the Connecticut River Near Holyoke, Mass." half-tone postcard, Hugh C. Leighton Co., Memorial Hall at Historic Deerfield accession 1999.03.0027 memorialhall.edu

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