1816: “THE MIGHTY OPERATIONS OF NATURE”: AN ENVIRONMENTAL HISTORY OF THE YEAR WITHOUT A SUMMER

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THESIS ABSTRACT

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The catastrophic eruption of the Indonesian volcano Mt. Tambora in April 1815, which ejected a cloud of sulfur dioxide into the upper atmosphere, plunged the world into a rapid temporary climate change event. A series of bizarre weather anomalies, including snowstorms in June and repeated heavy frosts throughout the rest of the summer, earned 1816 the moniker “the Year Without a Summer.” This paper examines the various ways in which Americans reacted to the climate change—seeking causation explanations through science and superstition, political and religious responses, and the efforts to appreciate what the events meant in terms of the world’s changing climate. Through these various reactions, a picture emerges of Americans’ incomplete understanding of science and nature, as well as an uneasy reckoning with the impossibility of fully explaining their environment and the potential dangers it presented to them.

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CHAPTER I

INTRODUCTION: PITCHING QUOITS IN THICK OVERCOATS

In 1860, on the eve of the Civil War, Chauncey Jerome, a 67-year-old New England clocksmith, recalled in his memoirs a particularly memorable summer that had occurred forty-four years before. “I well remember on the seventh of June,” he wrote, “while on my way to work...my hands got so cold that I was obliged to lay down my tools and put on a pair of mittens which I had in my pocket.” He noted that it snowed an hour that day. He also described the Fourth of July celebrations in Plymouth, Connecticut: “I saw several men pitching quoits in the middle of the day with thick overcoats on, and the sun shining bright at the same time. A body could not feel very patriotic in such weather.”[1] Jerome’s book was primarily a history of the American clock business. Yet the weather anomalies of a summer long past found their way into his memoirs; they were obviously on his mind until nearly the end of his life. He died in 1868.

A decade later, another memoir-writer similarly remembered the cold summer of 1816. Sarah Anna Emery, then a young New Hampshire woman, looked back on it in 1879, when she was in her nineties. She recalled Thursday, June 6, the day before the snow squall that Chauncey Jerome remembered. On a trip with relatives to Boscawen, New Hampshire, Emery and her party paused to attend the inauguration of Governor William Plumer. “Our teeth chattered in our heads,” she wrote, “and our feet and hands were benumbed...even Mr. Emery, who never feared anything, was a little discomposed.”

[1]Chauncey Jerome and Lockwood Barr, *History of the American Clock Business for the Past Sixty Years and Life of Chauncey Jerome* (New Haven, CT: F.C. Dayton, Jr., 1860), 31-32.

She recalled staying at an inn that night where she and her party clustered around the fireplace for warmth.[2]

From these accounts, each written decades after the event, emerge two haunting pictures of the "Year Without a Summer." Chauncey Jerome's image of men pitching quoits in their heavy overcoats on the Fourth of July is an artifact—a sort of anecdotal "sound bite"—that continues to resurface in folkloric accounts of the summer of 1816, even now, nearly two centuries later.[3] Emery's recollection of her party huddled around a fire echoes one of the most common observations made by contemporaries of this "cold, ungenial, unprolific and churlish" season,[4] namely, that it was so persistently cold that fires were required indoors even in the deep summer. This refrain reappears constantly in people's accounts.[5] The clarity of Jerome's and Emery's narratives, and their consistency both with contemporary observations and other remembrances written long after the event, suggest the indelible impression that the climate anomalies of 1816 made on the people who lived through them. Jerome and Emery both mentioned the snow squall of June 6-7, and both remembered the exact date. It is possible that the events of early June in New England may have triggered in certain observers what psychologists call a "flashbulb memory," a specific and unique type of recall that preserves the time, place and circumstance of an event, analogous to the taking of a snapshot.[6] Such recollections

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[2]Sarah Anna Emery, *Reminiscences of a Nonagenarian* (Newburyport, MA: William H. Huse & Co., 1879), 289.

[3]See Conclusion, note 10.

[4] John Quincy Adams to Abigail Adams, September 20, 1816, *John Quincy Adams, Writings of John Quincy Adams*, ed. Worthington Chauncey Ford (New York: The MacMillan Company, 1916), VI: 90.

[5]*See, e.g.*, Isaiah Thomas, Diary, June 8, 1816, Isaiah Thomas Papers 1748-1874, Mss. Octavo Vols. T, Vol. 8 American Antiquarian Society Archives, Worcester, MA.

[6]Roger Brown and James Kulik, "Flashbulb Memories," *Cognition* 5, no. 1 (1977): 73-99. In modern times

demonstrate the extraordinary quality, the oddness and the significance that observers associated with the event.

Yet there was another side too. Americans in the Early Republic possessed an incomplete and sometimes contradictory picture of the world around them—a worldview shaped not only by science, then still imperfectly formed in its methods and conventions, but by religious belief, superstition, folklore, and practical knowledge of the natural world and the environment. In this "pastiche of knowledge," no one category of information or belief possessed greater legitimacy than any other. From this pastiche of knowledge, Americans in 1816 drew not only potential explanations for what was happening to the weather and the climate, but also explanations as to why the anomalies might not have been so truly anomalous. In contrast to the strong reminiscences of Jerome and Emery, worthy of triggering "flashbulb memories," some in 1816 argued that these strange events were nothing surprising. They were, in the words of one Massachusetts editor, simply examples of "the mighty operations of nature, and though uncommon, are a part of the system of things."[7] This tone of resignation—whether hopeful or pessimistic—betrays the imperfections of Americans' worldview at this time. While at once they were desperate for an explanation, at the same time they were cognizant that they could perhaps never know it.

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the paradigm examples of "flashbulb memories" are when people recall where they were and what they were doing when they learned of traumatic events such as the assassination of John F. Kennedy, the space shuttle *Challenger* explosion or the terrorist attacks of September 11, 2001.

[7] "Spots on the Sun," *Essex Register* (Salem, MA), August 31, 1816, 2.

The Year Without a Summer was a dramatic example of large-scale temporary global climate change.[8] Being global in its scope and profound in its implications, without a doubt it was an important and momentous event. Historians have tended to treat the Year Without a Summer dismissively, regarding it as an amusing aside or an environmental anomaly with little capacity to tell us about the time in which it occurred. To the contrary, this paper will argue that the climate change events of 1816 are uniquely illustrative of broader trends in how the people of the time viewed their relationship to their environment. They evidence an embryonic appreciation of humankind's delicate and precarious position in a changing world that was incapable of being fully understood by scientific or rational means. The pastiche of knowledge from which the people of the time drew their answers did not purport to be comprehensive and capable of explaining everything, as we tend to view our modern scientific discourse. The gap between what the people of 1816 knew about the natural world and what their knowledge base was competent to explain is often difficult to discern, but the struggle to come to terms with what was essentially inexplicable shows a curious collective negotiation—and reckoning—with the limits of their understanding.

The important ways in which Americans sought to explain the anomalies demonstrate a number of key features of the reaction. The inordinate amount of attention given to astronomical phenomena in the summer of 1816, particularly sunspots,

[8] Throughout this paper, the reader should be cognizant that "weather" and "climate" are two different things. Simply put, weather is what is happening outside your window at the present moment. Climate is the overall aggregation of weather patterns and atmospheric and hydrological processes over an extended period of time and in a wider area than a single point source. We may have had a cold, wet winter in Eugene, Oregon, but that does not necessarily mean that the climate has gotten colder; a succession of cold, wet winters, or one such winter manifested worldwide, might indicate that a climate change could be taking place. The distinction between weather and climate is fairly basic, but often poorly understood. Modern deniers of anthropogenic climate change will sometimes attempt to refute the fact that *climate* is changing by using *weather* events, such as heavy snowfalls or a cold snap, to argue for a broader trend.

challenged both science and superstition. Theories that the cold summer was caused by sunspots were hotly debated, and though most expert opinion held that sunspots were not the cause, the public could not quite seem to shake the suspicion that they were somehow involved. Other theories of causation drew from different parts of the "pastiche of knowledge," but none—even some that, perhaps by coincidence, came close to the truth—seemed to resonate with any greater authority or persuasiveness than any other. The causation arguments illustrate a view of the natural world that occupied a transitional step between traditional belief-system knowledge, such as superstition and old wives' tales, and more systematic and rational approaches rooted in Enlightenment sensibilities.

Political reaction to the Year Without a Summer is a field almost wholly unexplored by historians. Public discussion of the events in the United States tended to focus on the weather's likely effect on the upcoming harvest, and this discussion undoubtedly had political undertones; in Europe, where the climate anomalies triggered full-scale famines in many areas, reactions manifested themselves in open riots and political unrest. This did not happen in the United States, but that does not mean that the anomalies weren't interpreted in a political context; there is some indication that political party affiliation correlated with a tendency to express optimism or pessimism about the likely harvest prospects. Furthermore, the tendency in some circles to deny what was happening—or deny that it was significant—evidences that the possibility of climate change was deeply unsettling to some Americans.

The anomalies unquestionably impacted people on a spiritual and cultural level. Concerns about the strange weather events became embedded in the narrative surrounding at least one end-of-the-world prediction that was prominent on both sides of

the Atlantic; the prediction involved sunspots, the suspected (by some) causal agent of the cold summer. Even beyond overt fears of apocalypse, the weather events drove Americans into their churches in large numbers in the summer of 1816, and at least in some areas served as the impetus for religious conversions and increased evangelical fervor. On a more subtle level the climate anomalies cast an uncomfortable pall of gloom, melancholy and apprehension over the nation and its public consciousness.

Perhaps most surprising to modern-day observers, the events of 1816's cold summer became a significant issue in an ongoing debate then occurring in America about climate change and the extent of man's responsibility for it. Lengthy arguments raged in newspapers that summer over whether the Earth's climate was growing warmer or colder, and depending on one's point of view, the climate anomalies were either strong evidence of a cooling trend, or a fluke that had to be dismissed or distinguished from the broader trajectory of a warming planet. Either way, the debate illustrated awareness, at least by some, that human activity—especially deforestation and cultivation—had the potential to alter the climate of the planet. The implications of this climate change were almost universally assumed to be either easily endurable or a positive good, perhaps even reflecting America's political destiny to dominate the continent and advance its democratic values by exerting dominion over its physical environment. It is in these debates that the historical relevance of the Year Without a Summer becomes most clear, as we seek in our own time to come to terms with anthropogenic global warming and to craft a socially, scientifically and politically appropriate response.

Finally, the ways in which the Year Without a Summer became assimilated into public memory—and the ways in which it has been forgotten—themselves demonstrate

the relevance of and the enduring fascination with this event. Except among scientists, who continue to debate the physical causes and effects of the anomalies, the summer of 1816 is remembered today almost exclusively in folklore and popular culture, where a few certain immutable tropes continue to be rehashed with regularity. Our popular remembrance of the Year Without a Summer oddly resembles reactions at the time: it is slightly colored with, though not dominated, by science, and it views the event with a sort of bafflement that implicitly weaves uncertainty and resignation into the narrative itself. In an era when our modern science should be able to, and frequently purports that it does, explain precisely what happened in 1816 and why, we still seem drawn to depictions of the event that include a certain degree of wonder and amazement. Perhaps by favoring these depictions, modern observers seek to participate in the events themselves on roughly co-equal terms with those who lived through it, who did not have the benefit of modern climatological disciplines to draw from. In this sense the cold summer of 1816 did not end with the vernal equinox. Its long tail continues right up until the present day.

The theme of continuance is an important one. The curious summer of 1816 is a snapshot in time, a frozen diorama of thought, attitude and belief in early nineteenth century America. For many people of that year, who like Sarah Emery chattered through snowstorms in June and like others lamented as their crops crumbled into frosty mush in August, it seemed as if the winter simply never ended. By remembering the Year Without a Summer in the way that we do today, however, we ensure that it continues, and in senses more meaningful than just the appreciation of an interesting historical event. Recent trends of anthropogenic global warming challenge us to consider: do modern Americans, two centuries after 1816, trust science more implicitly or fundamentally than

Chauncey Jerome and Sarah Anna Emery's contemporaries did? Do we not suffer from the same fears, or at least similar ones, that our planet might be slowly (or rapidly) becoming uninhabitable? The fact that these questions are still cogent today demonstrates, in and of itself, why the Year Without a Summer matters. We can see in it, reflected darkly, reflected incongruously, glimmers of our own time and our own world. Eighteen-sixteen should interest us because it can tell us about ourselves.

CHAPTER II

WINTER WITHOUT END: A NARRATIVE HISTORY OF THE YEAR WITHOUT A SUMMER

A. Beginnings: Tambora and "Mountain X"

Most accounts of the Year Without a Summer begin with Tambora. Since at least 1913, or possibly earlier,[1] the standard scientific explanation for the climate anomalies of 1816 has been that the massive eruption of Tambora in April 1815 ejected a large mass of ash and other tiny particulates into the upper atmosphere, which had the effect of diffusing sunlight and preventing a certain amount of solar radiation from reaching the surface of the Earth.[2] Acceptance of this view is not universal, even among modern climatologists.[3] Whether the "Tambora causation theory" is or is not the explanation for the Year Without a Summer, as a matter of scientific fact, is beyond the scope of this paper. Nevertheless, given the wide endorsement that the Tambora causation theory has received in the past century, it is relevant to understanding the events of 1816.

Tambora—usually called "Tamboro" or "Tamporo" in the nineteenth century[4]—is located on the island of Sumbawa, now Indonesia.[5] Prior to 1815 it may have been as tall as 14,000 feet, making it the tallest mountain in the archipelago. Its awakening seems to

[1] *See* Chapter VII, notes 29-31.

[2] Michael R. Rampino, Stephen Self, Richard B. Stothers, "Volcanic Winters," *Annual Review of Earth Planetary Science* 16 (1988): 73-99, 74-76.

[3] *See* J.P. Sadler, J.P. Grattan, "Volcanoes as Agents of Past Environmental Change," *Global and Planetary Change* 21, Issues 1-3 (July 1999):181-196.

[4] *National Gazette* (Philadelphia, PA), July 9, 1825, 4.

[5] Sumbawa was not under effective European colonial rule until later in the nineteenth century, but it was very close to the island of Java, which was then under British administration. The whole area later became the Dutch East Indies and eventually Indonesia.

have begun in 1812 when European observers reported rumbling sounds emanating from the mountain, which also ejected periodic clouds of ash.[6] On April 5, 1815, the mountain was rocked by a tremendous explosion. Lieutenant Governor Stamford Raffles likened it in his memoirs to cannon fire.[7] The mountain was relatively quiet for the next five days. Then, early in the evening of April 10, Tambora exploded in an eruption so powerful that it sheared off the top of the peak and spat a cloud of ash over 25 miles tall. Magma, which solidified as pumice, cascaded down the sides of the mountain, destroying native villages below.[8] The explosion and its aftermath killed at least 10,000 people immediately, and up to 90,000 died of disease and famine over the next two years. It was the most powerful volcanic eruption in 500 years,[9] possibly the most devastating in recorded history.[10] The volume of ash and other materials expelled from the volcano—"ejecta," in the parlance of volcanologists—was 100 times the amount emitted by the eruption of Mt. St. Helens in May 1980.[11]

If the climate anomalies of 1816 had a volcanic cause, there seems little reason to doubt that an eruption as large as Tambora's could have done it. Only in the last few years

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[6]C. Oppenheimer, "Climatic, Environmental and Human Consequences of the Largest Known Historic Eruption: Tambora Volcano (Indonesia) 1815," *Progress in Physical Geography* 27, no. 2 (June 2003): 231-32.

[7]Ibid. (quoting Stamford Raffles, *Memoir of the life and public services of Sir Thomas Stamford Raffles, F.R.S. &c., particularly in the government of Java 1811-1816, and of Bencoolen and its dependencies 1817-1824: with details of the commerce and resources of the eastern archipelago, and selections from his correspondence* (London: John Murray, 1830).

[8]Ibid., 233-34.

[9]Alan Robock, "Volcanic Eruption, Tambora," *The Earth System: Physical and Chemical Dimensions of Global Environmental Change*, ed.s Dr. Michael C. MacCracken and Dr. John S. Perry, *Encyclopedia of Global Environmental Change* (Chichester: John Wiley & Sons, 2002) 1:737-38.

[10]Oppenheimer, 255.

[11]Henry Stommel & Elizabeth Stommel, *Volcano Weather: The Story of 1816, The Year Without a Summer* (Newport, RI: Seven Seas Press, 1983), 10.

has a more complex story begun to emerge. Evidence of a global fallout of Tambora ejecta is scientific fact: a layer of it, dated to 1815, can be seen in ice cores taken in Greenland and Antarctica.[12] Scientists have recently identified, however—in the same ice cores—evidence of a previous volcanic eruption of sufficient magnitude to affect climate. Given the placement of layers of sulfur dioxide in ice cores from both poles, researchers know that a major volcanic eruption occurred somewhere in tropical latitudes, and they can date its eruption to approximately February 1809. If evidence of a significant eruption in this time frame exists in historical records, it has not yet been identified as such. Consequently, the identity and location of this "Mountain X" is unknown.[13]

The revelation of the "Mountain X" eruption alters the scientific narrative of the Year Without a Summer. Instead of a global climate change directly caused by the single event of the April 1815 Tambora eruption, the emerging theory paints a picture of the Earth's climate, already affected by the 1809 "Mountain X" eruption, being given a sudden large shove in the same direction six years later by Tambora. Indeed, even before Tambora, there is significant evidence that the years 1810 and 1811 were generally colder than average.[14] The beginning of a cold period around 1810 may account for some of the controversy in scientific circles about whether Tambora can be considered a causal agent of climate change at all—such contentions usually argue that temperature and climate

[12]Robock, 738.

[13]Jihong Cole-Dai, David Ferris, Alyson Lanciki, et. al., "Cold Decade (AD 1810-1819) Caused by Tambora (1815) and Another (1809) Stratospheric Volcanic Eruption," *Geophysical Research Letters* 36, no. L22703 (November 21, 2009): 2. According to this analysis, only stratospheric eruptions in tropical latitudes can result in deposition of sulfur dioxide at both poles. This sort of eruption is also the only kind of volcanic eruption that can result in a global climate change.

[14]Ibid, 2-3.

anomalies in 1816 were not significantly worse than lows in other years with which volcanic cause is not associated, including the early 1810s.[15]

People at the time may not have connected the eruption of Tambora with climate anomalies, but they clearly knew it was a significant eruption. Evidence of the disaster lingered for months after the April blast. In October 1815, a passenger on the British ship *Fairlie* recorded seeing "quantities of stuff...burnt cinders, evidently volcanic" covering the sea for two days in a region about 1500 miles southwest of Sumbawa.[16] This was most likely a raft of pumice from the eruption of Tambora.[17] As news traveled slowly from the tropical Pacific—typically it first had to reach the capitals or ports of the European countries who held colonies there—American newspaper readers seem to have first learned of the eruption of Tambora in the latter part of February 1816, where a widely-reprinted article speculated on the connection between it and another recent eruption on the island of Batavia (Java).[18] By that time the Earth's climate was undoubtedly under the effect of the Tambora eruption, and the strangest season in the memory of many Americans were about to begin.

B. 1815 to Spring 1816: The Anomalies Begin

The first atmospheric effects of the Tambora eruption discernible to humans were probably the sunsets. In the summer of 1815, many people noted the presence of

[15]Sadler & Grattan, 188.

[16]*Independent Chronicle* (Boston, MA), July 4, 1816, 1.

[17]Oppenheimer, 241.

[18]*New York Evening Post*, February 27, 1816, 2.

spectacular sunsets, especially in London.[19] The stunning color of the sunsets that year may have influenced English Romanticist painter J.M.W. Turner, who painted a number of landscapes after 1815 portraying abnormally brilliant or colorful skies.[20] The skies were not the only thing that the eruption of Tambora may have colored. On New Year's Eve, in Terramo, Italy, an unusual quantity of snow fell, and according to reports widely circulated on both sides of the Atlantic it was colored red and yellow.[21] The strange coloration was most likely the result of sulfur dioxide particles from the eruption suspended in the atmosphere.[22]

There does not seem to have been a widespread perception, at least in New England and the rest of the eastern United States, that the winter of 1815-16 was particularly harsh or cold. When the winter began to linger unusually long into the spring, however, people began to take notice. Comments from diarists begin to show concern and puzzlement about the weather in April and early May. It was common in the early nineteenth century for people to make a short record of the day's weather, usually at the beginning of a diary entry. If the diarist was diligent, a relatively accurate reconstruction of weather conditions at specific point sources can be reconstructed. William Paine, a doctor residing in Worcester, Massachusetts, provides such a source. Entries for his diary show the words "cold" or "very cold" in five of the first seven days of May. On May 8 he noted "[W]eather cold, but very dry."[23] Drought conditions had persisted at least since

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[19]Oppenheimer, 244.

[20]Stanley Williams and Fen Montaigne, *Surviving Galeras* (Boston: Houghton Mifflin, 2001), 198.

[21]*Camden Gazette* (Camden, SC), June 6, 1816, 4.

[22]John D. Post, *The Last Great Subsistence Crisis in the Western World* (Baltimore: The Johns Hopkins University Press, 1977), 25.

[23]William Paine, Diary, May 1-8, 1816, Paine Family Papers c. 1721-c.1918, Octavo Vol. 33, American

April.[24] At this same time newspapers were reporting heavy snows in Quebec in mid-April, leading to cattle die-offs and rising grain prices.[25] Early May was also a period of intense interest in sunspots, which were more visible than usual at this time.[26]

The first true weather shock of the year struck on May 14. On that day a severe cold front affected much of the eastern United States, bringing snow to many areas. Dr. Paine's diary describes May 14 as "showery," "squally," and bearing a "snow wind."[27] Isaiah Thomas, the venerated philanthropist who founded the American Antiquarian Society and who also lived in Worcester, reported in his diary that there was "some snow."[28] Joseph Goffe, a diarist who lived near Boston, also reported a snow squall on May 14.[29] Enough snow fell in Albany, New York to cover rooftops.[30] The next day there were frosts and deep cold in Philadelphia, Richmond,[31] and regions along the Ohio River.[32] Frost was again reported in Richmond on May 30; a newspaper noted that "[t]this is an extraordinary Spring."[33]

Antiquarian Society Archives, Worcester, MA.

[24]Joseph Goffe, Diary, April 1816 (interlineated in *The Clergyman's Almanack*), Joseph Goffe Papers 1721-1846, Mss. Octavo Vols. G, Octavo Vol. 14, American Antiquarian Society Archives, Worcester, MA.

[25]*Poulson's American Daily Advertiser* (Philadelphia, PA), May 4, 1816, 3.

[26]See Chapter III.

[27]Paine, Diary, May 14, 1816.

[28]Thomas, Diary, May 1816.

[29]Goffe, Diary, May 1816.

[30]*London Times*, July 20, 1816, 3.

[31]*Columbian Register* (New Haven, CT), June 1, 1816, 3.

[32]*London Times*, July 20, 1816, 3.

[33]*Richmond Enquirer* (Richmond, VA), June 4, 1816, 3.

Extraordinary though frosty temperatures might be in Virginia in late May, snow in New England is not *that* unusual at this time of year.[34] The rest of the month seems to have been much more typical. At least in some places the season appears to have warmed in late May and early June. Georgia, in fact, suffered a heat wave; temperatures above 90 degrees Fahrenheit were recorded on May 29 and June 3.[35] There was also a warming trend in New England. Dr. Paine's and Isaiah Thomas's diaries do not contain weather observations for this crucial week at the end of May and beginning of June, a week which contained the change in weather, but Ruth Henshaw Bascom, another Massachusetts diarist, reported that Wednesday, June 5 was clear and warm, with a thunderstorm in the evening.[36] A precise temperature reading at Williamstown, Massachusetts, taken that day has survived: 83 degrees Fahrenheit.[37] The next, and to many people the most memorable, weather event was about to occur.

From temperatures in at least the low eighties, on June 5-6 the mercury plunged forty-three degrees in Boston and forty-nine degrees in Salem, Massachusetts, over the course of twenty-six hours.[38] A similar severe temperature swing of at least forty degrees

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[34]Choosing a data set at random, weather records for Worcester, Massachusetts show that in thirty-four Mays spanning roughly the middle third of the twentieth century, snow was recorded in eleven of them. In almost all cases it was a trace of snow, which was recorded in 1947, 1954, 1959, 1963, 1964, 1967, 1968, 1970, and 1977. In May 1945, 1.5 inches of snow fell. The only other snowfall greater than this was in May 1978, when Worcester received a staggering 12.7 inches of snow—definitely a blizzard. *Weather of U.S. Cities* (Detroit, MI: Gale Research Company, 1981), 492-93. Due to the effects of anthropogenic climate change developing during this period, however, this data set may not be truly representative of how "usual" snow in May was in the early nineteenth century.

[35]*Georgia Journal* (Milledgeville, GA), June 5, 1816, 3.

[36]Ruth Henshaw Bascom, Diary, Ruth Henshaw Bascom Papers, Mss. Octavo Vols. B, Vol. 23 (1816), American Antiquarian Society Archives, Worcester, MA.

[37]Willis I. Milham, "The Year 1816—The Causes of Abnormalities," *Monthly Weather Review* 52, no. 12 (December 1924): 563, 564 (citing Williamstown, MA Meteorological Observation Book, June 1816).

[38]*American Telegraph* (Brownsville, PA), July 3, 1816, 2.

was noted in Albany, New York, as the cold front moved in.[39] Snow was already falling in Bennington, Vermont on Wednesday, and continued for the next thirty hours.[40] On Thursday, June 6, the rest of New England experienced similarly wintry conditions. Snow fell during the day in Marlboro, Vermont, and began in the evening in Hollowell, Maine.[41] The storm was especially severe in Quebec, which saw not only snow measuring a foot deep but also a great die-off of birds that simply dropped out of the sky from cold.[42] One newspaper reported snow eighteen inches deep in Waterbury, Vermont.[43] It is unlikely this is a raw snowfall measurement; perhaps the reporter had measured a snowdrift or simply exaggerated, but it is undeniable that significant quantities of snow fell in New England that day.

Thursday, June 6, was the day Sarah Anna Emery attended the inauguration of New Hampshire Governor William Plumer and spent the evening in an inn shivering around the fireplace. The next day, Friday, June 7, was the day recalled so vividly by Chauncey Jerome forty-four years later. It was still snowing in some places on Friday, including Hollowell,[44] but it was exceptionally cold just about everywhere on the Eastern Seaboard. The Worcester diarists, Isaiah Thomas and Dr. Paine, did not record snow that day, but both commented on the cold,[45] the former observing, “Fires as agreeable as in

[39]*Albany Argus*, June 11, 1816, 2.

[40]*Green-Mountain Farmer* (Bennington, VT), June 10, 1816, 2.

[41]*Connecticut Mirror* (New Haven, CT), June 24, 1816, 2.

[42]*New-England Palladium & Commercial Advertiser* (Boston, MA), June 21, 1816, 2.

[43]*American Beacon* (Norfolk, VA), July 1, 1816, 3.

[44]*Connecticut Mirror* (New Haven, CT), June 24, 1816, 2.

[45]Paine, Diary, June 7, 1816; Thomas, Diary, June 7, 1816.

Winter."[46] Jacob Porter, like Sarah Anna Emery, was traveling that weekend. On June 7 he rode from Concord, New Hampshire, to Shrewsbury, Massachusetts, noting: "At Sudbury I was informed that there was a severe frost in that place this morning and ice nearly as thick as window glass."[47] The snowfall in Boston is said to have aroused fear in the local populace.[48]

The snowstorm of Friday, June 7, was also the day on which another famous incident allegedly occurred. According to the story:

> In Peacham, VT, on the 7th of June, Mr. Joseph Walker, aged 88, lost himself in a wood in a *snow storm*, and his feet were *frozen* so that it was necessary to amputate his toes![49]

The Walker amputation story—an unforgettable and colorful anecdote—was repeated by many papers across the United States.[50] Beyond this one oft-repeated account there is no other record of Joseph Walker. Although the story cannot be verified, it has survived well into modern times, having been asserted as truth as late as the 1980s.[51] The Walker story is not the only folk tale generated by the events of that specific day. James Winchester, a Vermont native, told a similar, even more dramatic story to a newspaper in the 1890s, in which his uncle lost his way in the snow and froze to death on June 17,

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[46]Ibid. Interestingly, Thomas records "*Snow* in several places" the next day, Saturday, June 8, but it is unclear whether he means that snow actually fell in Worcester or if he was reporting that he had heard of snowfalls in other places (which I judge to be more likely).

[47]Jacob Porter, Diary, June 7, 1816, Jacob Porter Papers 1802-1846, Mss. Boxes P, American Antiquarian Society Archives, Worcester, MA.

[48]William Jenison, Diary, June 8, 1816, Jennison Family Papers 1729-1860, Mss. Octavo Vols. J, Vol. 9, American Antiquarian Society Archives, Worcester, MA. Jenison recorded this on June 8, but does not assert the snowfall happened that day; he is probably referring to the previous day.

[49]*Georgetown Gazette* (Georgetown, SC), September 14, 1816, 3.

[50]*See, e.g.*, *Reporter* (Brattleboro, VT), September 17, 1816, 3.

[51]Stommel, *Volcano Weather*, 103.

1816. This tale, which also cannot be verified, purports to represent the summer's only confirmed fatality.[52] Winchester insisted the date was June 17,[53] but while it seems to have been cold that day in New England in general, there is no record of significant snowfall on that day in Vermont or anywhere else, and thus he was almost certainly referring to the June 7 storm.

On Saturday, June 8, the storm abated but the cold persisted. Continuing his journey from Shrewsbury, Massachusetts, to Brookfield, Jacob Porter remarked, "The Lapland weather still continues."[54] The nightmare weekend apparently ended with fair weather, but remained especially cold.[55]

The weather in Boston was clear enough on the evening of Sunday, June 9, for observers in the city to witness a total lunar eclipse. According to contemporary almanacs, the moon would rise eclipsed at 7:26 PM, with the period of totality lasting from 7:55 to 9:07.[56] These predictions were matched almost exactly by newspaper accounts of the eclipse itself, where it was said that in Boston "[t]he evening was clear."[57]

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[52]Ibid., 101-02. I was unable to identify the exact newspaper in which the story ran or the date. The Stommels' book, which appears to be aimed at a popular science audience, is poorly sourced insofar as historical records are concerned, and simply says that the account "comes from a newspaper clipping on file at the Vermont Historical Society." Ibid., 166.

[53]"The big storm of the 17th began along about noon..." Ibid., 102 (quoting unsourced account of James Winchester, 1892).

[54]Porter, Diary, June 8, 1816.

[55]Thomas, Diary, June 9, 1816.

[56]*The Clergyman's Almanack; Or, an Astronomical Diary and Serious Monitor, For the Year 1816* (Boston: Printer for the Author, 1815), 2. This is the book that has been cited in this work as Joseph Goffe, Diary. Goffe's notes and entries are written on pages of the printed almanac itself. The Isaiah Thomas Diary also takes this form.

[57]*New-England Palladium and Commercial Advertiser* (Boston, MA), August 30, 1816, 2. Modern astronomical data compiled by NASA indicates slightly different times.

The eclipse, centered over the South Atlantic,[58] was visible from London as well, where it was also clear.[59] At least in New England, the appearance of a lunar eclipse immediately after the bizarre June snowstorm cannot have failed to have struck some observers as eerie.

Over the next few weeks the weather fluctuated wildly. Cold seems to have persisted in parts of Massachusetts until June 17.[60] Isaiah Thomas noted the previous day that "[f]ires continue to be regularly made in our parlors."[61] That same week, a gale raged farther south; a ship, the *Homer*, was sunk in the storm off the coast of Charleston, South Carolina, around June 16. A Charleston newspaper observed:

> It is very remarkable, at this season of the year, to witness a northeasterly gale of five or six days continuance....Indeed the seasons, for the last six months, appear to have experienced a complete revolution. During the continuance of the storm, the weather was so cold as to render a fire not uncomfortable; and now we are, after an interval of three days, scorching under the most ardent rays of a summer sun.[62]

Heat soon struck New England too. On June 22, after five days of sun, the temperature in Boston was 96 degrees Fahrenheit.[63] It was the first day of summer.

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[58]NASA, "Five Millennium Canon of Lunar Eclipses," http://eclipse.gsfc.nasa.gov/5MCLEmap/1801-1900/LE1816-06-10T.gif (accessed January 19, 2012).

[59]*New-England Palladium and Commercial Advertiser* (Boston, MA), August 30, 1816, 2.

[60] Paine, Diary, June 17, 1816.

[61]Thomas, Diary, June 16, 1816.

[62]*Connecticut Journal* (New Haven, CT), July 2, 1816, 2 (reporting dispatch from Charleston, SC).

[63]*Poulson's Daily Advertiser* (Philadelphia, PA), 28, 1816, 3.

C. Summer 1816: Fluctuations and Frost

The heat wave in the last week of June 1816 was severe. Diarist Ethan Allen Greenwood recorded that in Boston on June 23 the mercury rose to 102 degrees.[64] In Salem, it was 101 on the same day.[65] The weather quickly changed across the region. In Albany, New York, temperatures fell the next day, June 24, as clouds moved in, bringing another severe storm.[66] Although it manifested itself as heavy rain in Massachusetts,[67] three feet of snow were reported in parts of Quebec.[68] Temperatures rose around June 28, then plunged again at the beginning of July.[69] The unusually erratic nature of the weather resulted in conditions that varied widely from day to day, even hour to hour.

On July 2, a weather-related event occurred that would be widely repeated throughout the summer and figure in later conjectures about the causes of the climate anomalies. A violent thunderstorm burst over West Chester, Pennsylvania, that Tuesday afternoon, bringing hail strong enough to smash window glass. A shower of stones—quartz, feldspar and flint, according to observers—fell into the yard of one Colonel McClellan. The stones were said to be the size of walnuts, and none of the types of stones described in the incident were believed to be of local origin.[70]

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[64]Ethan Allen Greenwood, Diary, June 23, 1816, Ethan Allen Greenwood Papers 1801-1839, Mss. Octavo Vols. G, Vol. 21, American Antiquarian Society Archives, Worcester, MA.

[65]*Camden Gazette* (Camden, SC), September 12, 1816, 1.

[66]*Vermont Gazette* (Bennington, VT), July 23, 1816, 3.

[67]Paine, Diary, June 25, 1816.

[68]*Montreal Gazette*, September 30, 1816, 3.

[69]Paine, Diary, June 28-July 4, 1816.

[70]*Essex Register* (Salem, MA), July 10, 1816, 3.

The Fourth of July, a Thursday in 1816, saw chilly weather across much of New England. The other element of Chauncey Jerome's iconic reminiscences—the image of players pitching quoits while wearing cold-weather gear—dates from this day.[71] In this era the traditional celebrations of Independence Day took place outdoors, often involving barbecues, orations, toasts and games often convened by entire communities in town squares and other public spaces.[72] While the weather was not cold enough to transform these celebrations into winter festivals, observations such as Chauncey Jerome's demonstrate that New Englanders observing the Fourth certainly noticed and appreciated the strangeness of the climate that summer.

Cold weather persisted throughout July in most places. Isaiah Thomas recorded frost on the morning of July 8 and remarked the next day, once again, about how fires indoors were necessary.[73] In Maryland, the weather in mid-July was described as "clear and cool," but farmers were still going about their harvests as best they could.[74] For some observers, even as far south as Virginia, it seemed that summer had not yet arrived at all. A writer in a Norfolk newspaper complained:

> It is now the middle of July, and we have not yet had what could properly be called summer. Easterly winds have prevailed for nearly three months past...[t]he sun during that time has generally been obscured and the sky overcast with clouds; the air has been damp and uncomfortable, and frequently so chilling as to render the fireside a desirable retreat.[75]

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[71]Jerome, 32.

[72]Len Travers, *Celebrating the Fourth: Independence Day and the Rites of Nationalism in the Early Republic* (Amherst: University of Massachusetts Press, 1997), 208-17.

[73]Thomas, Diary, July 8-9, 1816.

[74]*Boston Independent Chronicle*, July 22, 1816.

[75]*Columbian Register* (New Haven, CT), July 27, 1816, 2.

This was also the case on the other side of the Atlantic. The London *Times* reported unseasonable cold and incessant rain during July,[76] an observation echoed by John Quincy Adams, then American minister to the Court of St. James. On July 19 he recorded that the weather was "so unusually and constantly cold that fires have been kept without intermission in almost every house."[77] Indeed the only isolated pockets in the Atlantic world that were not suffering from cold, heavy rain, or both seemed to be in the American Deep South: in Charleston, South Carolina, a heat wave in the third week of July drove temperatures high enough to cause casualties from heat stroke.[78]

August brought both warm and cold to many regions. Widespread frosts, particularly in the later part of the month, adversely affected crops in Maine, Massachusetts, New Hampshire, Vermont, parts of New York, and Canada.[79] Frost also struck Virginia on August 20 and 21.[80] William Paine and Isaiah Thomas, both in Worcester, each described conditions on these days as "very cold" or "severe."[81] In Utica, New York around August 29, not only was severe frost reported, but "ice nearly the thickness of a dollar."[82] Yet the cold conditions were not observed everywhere, and they fluctuated wildly. Joseph Goffe recorded August as "a warm month."[83] In Albany, New York, a high of 80 degrees was recorded in the morning, and that same night it was cold

[76]*London Times*, July 20, 1816, 3.

[77]John Quincy Adams, *Memoirs of John Quincy Adams, Comprising Portions of His Diary from 1795 to 1848*, ed. Charles Francis Adams (Philadelphia: J.B. Lippincott & Co., 1874), III: 404-05.

[78]*Essex Register* (Salem, MA), August 10, 1816, 2. Temperatures were said to be 95 degrees in the shade.

[79]*Boston Intelligencer*, September 7, 1816, 2.

[80]*American Beacon* (Norfolk, VA), September 9 1816, 3.

[81]Paine, Diary, August 22, 1816; Thomas, Diary, August 21-26, 1816.

[82]*Daily National Intelligencer* (Washington, DC), September 9, 1816, 2.

[83]Goffe, Diary, August 1816.

enough to frost.[84] That cold and warm air masses were clashing violently over much of the Eastern Seaboard is borne out by numerous reports of violent thunderstorms in the latter weeks of August, in New England[85] and locations in mid-Atlantic states.[86] Thunderstorm activity is common where warm and cold air masses collide.[87]

By September it seemed that people everywhere had become weary of the strange climate. It was now harvest-time for many crops, and farmers of all classes were concerned with the weather's depressing effect on their yields.[88] Despite spotty patches of warm or even unseasonably hot weather, the perception was taking shape that the winter of 1815-16 had never really ended, and continued in an essentially unbroken continuum right through the spring and summer. Isaiah Thomas, after noting that the summer "has been the most extraordinary that I can remember" (he was then sixty-seven years old), noted that there had been a frost in every month since the previous autumn.[89] From London, John Quincy Adams wrote to his mother that "we have had...not one evening and scarcely a day in 1816, when a fire would have been superfluous."[90] Even before the autumnal equinox officially rang out the extraordinary season, the idea that 1816 was a "Year Without a Summer" seems to have already taken hold in the public consciousness.

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[84]*Albany Argus*, August 23, 1816, 3.

[85]Paine, Diary, August 18, 1816.

[86]*Albany Argus*, August 22, 1816, 2.

[87]Choji Magono, *Thunderstorms* (Amsterdam: Elsevier Scientific Publishing Company, 1980), 2-3.

[88]*Boston Intelligencer*, September 7, 1816, 2.

[89]Thomas, Diary, August 31, 1816.

[90]John Quincy Adams to Abigail Adams, September 20, 1816, *Memoirs*, VI: 90.

D. Into the Autumn: Frost, Hurricane and Fire

In September, a month that would normally have trended cooler even without the volcanic climate changes, reports of severe frosts were rampant. Frost was responsible for the destruction of tobacco crops in Virginia,[91] corn in Massachusetts[92] and vegetables in New York state.[93] In Northampton, Massachusetts, a day of prayer and fasting was declared in early September due to drought, cold and crop failures.[94] In the later part of the month, Massachusetts and New Hampshire experienced "four of the greatest frosts ever remembered here at this season of the year."[95] The mean temperature for the month of September in Williamstown, Massachusetts, was 55 degrees Fahrenheit, only slightly warmer than May.[96]

In early September communities up and down the Atlantic coast experienced what may have been a hurricane, or something close to it. In Petersburg, Virginia, heavy rain began on September 6 and continued unrelenting for the next week.[97] The rain began in Philadelphia on the 8th, a Sunday, and hit Boston on the 12th. The storm was characterized as a "gale." New York City received a staggering ten inches of rain over the course of sixty-six hours.[98] In Rhode Island the storm evidently manifested itself as a classic Nor'easter, with rain falling "in torrents, almost without intermission, for eight

[91]*American Beacon* (Norfolk, VA), September 7, 1816, 3.

[92]Goffe, Diary, September 26, 1816.

[93]*Columbian Register* (New Haven, CT), October 12, 1816, 2.

[94]*Richmond Enquirer* (Richmond, VA), September 7, 1816, 2.

[95]*Boston Independent Chronicle*, October 7, 1816, 2.

[96]Post, 10.

[97]*Essex Register* (Salem, MA), September 21, 1816, 2.

[98] *Albany Argus* (Albany, NY), September 20, 1816, 2.

days in succession."[99] Although hurricanes were not recognized or classified in the early 19th century as they are today, the reports of the storm, its widespread geographic coverage, and the time of year in which it occurred all seem to point to a strong tropical storm that struck at least a glancing blow on the east coast of the United States.

Some people believed that the great storm of September 1816 was foretold in the skies shortly before it happened. On September 8, just before the heavy rains began, "solar halos"—also commonly called "sun dogs"—were observed in New England skies between two and three o'clock in the afternoon. These bright halos surrounding the sun were said to have shone with prismatic qualities and lasted nearly an hour. "Halos or circles, around the sun or moon," remarked a Rhode Island newspaper, "have always been considered as the precursors of rain." This same paper identified the torrential downpour that began the next evening as a specific fulfillment of this "precursor."[100] In fact such solar phenomenon has, in modern scientific understanding, been associated with volcanic particles suspended in the stratosphere.[101]

While coastal areas reeled from a deluge, areas further inland had the opposite problem: drought. Contemporary reports throughout the summer mention disturbingly dry conditions in many areas,[102] but by early October Maine's forests and fields, dry and parched, their yields stunted by numerous hard frosts, were a tinderbox ready to explode. Fires began in Oxford County sometime in the first week of October. The blazes were impossible to combat due to the low level of water in local streams; what crops weren't

[99]*Daily National Intelligencer* (Washington, DC), October 3, 1816, 3.

[100]Ibid. (quoting the *Rhode Island Republican*, September 11, 1816).

[101]Richard B. Stothers, "Cloudy and Clear Stratospheres Before 1000 A.D. Inferred from Written Sources," *Journal of Geophysical Research* 107, no. D23 (2002): 17-1.

[102]*Dedham Gazette* (Dedham, NH), July 19, 1816, 1.

already decimated by frost were consumed by fire.[103] Vast clouds of smoke from the Maine fires began to drift over New England, reaching Boston no later than October 7.[104] William Paine recorded in his diary, "[A]tmosphere appears to be full of smoak."[105] A writer in Albany, New York, after lamenting that the ground had not received a drop of moisture since June, went on to remark that "the woods are every where on fire, and the smoke so thick, that while I now write, at 4 in the afternoon, to' there are no clouds, the sun is not to be seen."[106]

When the fires ended—there is no record of them after mid-October—the weather was now uniformly cold and communities were bracing for winter. The cold summer and numerous weather shocks had resulted in poor harvests across the United States, from New England to the South, with the worst effects centered in the West.[107] Indeed across the entire Atlantic world, disappointing harvests were common; their effects were especially severe in Europe, where local and national economies were still fragile from the ravages of twenty years of war.[108] The threat of hunger was real in many places in America as well. In November, a Quaker missionary in western New York wrote to his governing committee appealing for cash to buy corn for local Indians, whose crops had been wiped out by the frosts and whose families were already on the verge of destitution.[109] Even the *Essex Register*, a Salem, Massachusetts paper that had spent

[103]*Essex Register* (Salem, MA), October 5, 1816, 3.

[104]*Dedham Gazette* (Dedham, NH), October 11, 1816, 1.

[105]Paine, Diary, October 1, 1816.

[106]*Richmond Enquirer* (Richmond, VA), October 19, 1816, 4.

[107]Post, 13.

[108]Ibid., 36-53.

[109]Jacob Taylor to Thomas Winter, November 15, 1816, the Philadelphia Yearly Meeting, Indian Committee

much of the summer simply denying that any significant climate anomalies were taking place,[110] was forced to admit that harvests were generally bad, though it added hopefully that "when we settle the year's account, it will not be the *worst* ever known."[111]

Most narratives about the Year Without a Summer end with the harvest and the anxieties it caused. In reality, however, the weather anomalies did not end with the return of cold weather in its normal course in the fall of 1816. The long wake of the Tambora disaster—which will be discussed in a later chapter[112]—was by no means over simply because its odd, climate-shifting weather events became indistinguishable from those normally occurring in the autumn and winter. Indeed, as the trees lost their leaves and the snows returned again in November and December 1816, the people of the eastern United States seem to have had no sense that anything was truly ending. The accustomed winter was not beginning anew. It had simply never ended.

Records, Microfilm F824, American Philosophical Society, from Quaker Collection Originals, Special Collection, Haverford College, Philadelphia, PA.

[110]See Chapter IV, Section C.

[111]*Essex Register* (Salem, MA), October 16, 1816, 1 (emphasis added).

[112]Chapter VII.

CHAPTER III

"THE GREATEST ACTIVITY OF THE CAUSE": SCIENCE, PSEUDOSCIENCE AND THE CAUSATION ARGUMENT

A. The Sunspot Obsession

Such an extraordinary event as the Year Without a Summer, global in scope and potentially catastrophic in its consequences, could not have occurred without intense public discussion of its causation. Americans in 1816—and many overseas—speculated, hypothesized, wrote, responded, argued and joked about the potential causes of the climate events. The contentious public conversation regarding causation provides one of the key insights into the worldview of Americans in this era and how they evaluated the physical world around them. Part science, part superstition and part practical knowledge of the land and nature, the sources of this worldview represented various areas of thought that were sometimes symbiotic and sometimes contradictory, in an era where science had not yet fully emerged into the light of day as a trusted and presumably rational discipline for understanding the environment.

Judging from the frequency of its mention in public discussion, the contemporary explanatory theory that seems to have had the most cachet in the public mind was sunspots. The theory was not usually elucidated in scientific or even pseudoscientific terms: it was largely a naked assumption that increased sunspot activity concomitant with climate change could not be pure coincidence. A Boston newspaper summed up the sunspot causation theory succinctly:

> The philosophers assure us there is nothing to be apprehended from the spots on the sun; but by a strange coincidence, the coldness of the present

> season, both in Europe and America, has chilled the earth at the very period when those spots were largest and occurred most frequently.[1]

Another newspaper in the same city, proceeding more cautiously, concluded that it was "at least worthy of remark" that sunspots, "each time, have been preceded by an extraordinary change in the weather."[2] This was in the first few days after the June 7 snowstorm, when doubtless public interest in the weather anomalies was high.

Sunspot causation was something akin to a popular superstition. The reasoning was fairly simple: because the sun warms the Earth, sunspots—whatever they are—darken the disk of the sun and thus allow less solar radiation to reaching the Earth than would otherwise be the case. This belief was not held in high regard by experts or educated persons in general. An editorial, written in late June, evaluating this theory mentions that it was the butt of ridicule:

> The notion is so generally laughed at, that one dare hardly ask, 'if the spots on the sun may not have had some influence in producing our late unexampled cold weather? Is it certain that 'the thing is impossible?'...If the rays from 30,000 miles of [the sun's disk] affects not the heat of this planet, would an object covering 60,000 miles or a million of miles, render it colder here?[3]

Scientists were quick to push back against this theory. Probably the most influential astronomer in the world in 1816 was the German-born British scientist William Herschel, discoverer of the planet Uranus and some of its moons.[4] When

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[1] *Boston Intelligencer*, September 7, 1816, 2.

[2] *Boston Independent Chronicle*, June 10, 1816, 2.

[3] *Columbian* (New York, NY), June 27, 1816, 2. The writer is assuming that sunspots are caused by some celestial object lying between the sun and the Earth, which was a fairly common supposition.

[4] In fact Uranus was widely, though not officially, called "planet Herschel" in his honor up until the 1850s. Mark Littmann, *Planets Beyond: Discovering the Outer Solar System* (New York: John Wiley & Sons, Inc., 1988), 9-11.

Herschel opined that sunspots were harmless, his opinion was regarded by many as definitive.[5] He went so far as to plot sunspot activity on a graph against an analysis of the price of wheat, and pronounced that the lack of correlation between them was proof that they did not and could not affect climate.[6] Another German, a Dr. Sturmer—his exact credentials unknown—wrote from Nuremburg in late June that "there is no connection between them [sunspots] and the weather, which is rather influenced by winds and vapours." Sturmer cited data from 1761 and 1783, both years of remarkable sunspot activity, where there were no observable climate effects, and harvests and vintages were bountiful.[7] John Quincy Adams, an enthusiastic observer of scientific as well as political phenomena, was not willing to endorse unequivocal belief in either the scientists or the popular wisdom: "What agency the spots in the sun have had in all this," he wrote to his mother in September, "is more than I, or perhaps anybody else is astronomer enough to know."[8]

Regardless of whether people believed they caused the weather anomalies or not, the general subject of sunspots was a virtual obsession in the spring and summer of 1816. The appearance of a new spot, or a significant change in existing spots, was frequently reported in the news.[9] In early May, which seems to have been the most intense period of visible sunspot activity, the Washington, D.C. *Daily National Intelligencer*, the semi-official mouthpiece of the James Madison administration, published an ongoing series of

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[5]"Spots on the Sun," *Essex Register* (Salem, MA), August 31, 1816, 1-2.

[6]"The Climate," *Connecticut Journal* (New Haven, CT), September 17, 1816, 2.

[7]*Connecticut Journal* (New Haven, CT), September 3, 1816, 2.

[8]Letter, John Quincy Adams to Abigail Adams, September 20, 1816, *Memoirs*, III: 90.

[9]*See, e.g., Boston Independent Chronicle*, June 10, 1816, 2.

articles detailing sunspot minutiae and hypothesizing as to the cause and nature of the spots. Most of the articles were credited to a particular writer who signed them simply "Z." "Z" made it perfectly clear that he did not believe sunspots were responsible for the weather anomalies. "[A] spot on the Sun, which does not cover a ten thousandth part of its surface," he argued, "can produce no sensible diminution of his light or heat." Adopting an almost sneering tone at those who were alarmed by sunspots, "Z" cautioned that "*real* evils are numerous—we ought not to create *imaginary* evils."[10]

Despite his apparent disdain for the sunspot causation argument, "Z" served the readers of the *Daily National Intelligencer* a veritable smorgasbord of sunspot facts, factoids and naked conjecture. As well as chronicling the appearance, location and probable size of particular sunspots,[11] he gave much attention to various theories of what they are: "solid opaque bodies swimming upon the liquid matter of the sun," "excavations in the luminous matter of the sun," or even craters left by the impact of a comet, which may have carried away enough solar matter to form a new planet.[12] Comet collision was evidently the pet theory of a Philadelphia astronomer, David McClure, who cited a 1680 work by Isaac Newton as its inspiration.[13] This theory, reminiscent of the unorthodox ideas of Velikovsky in a much later era,[14] aroused controversy; one irate Massachusetts

[10]*Daily National Intelligencer* (Washington, D.C.), May 9, 1816, 3.

[11]"Spots on the Sun's Disk," *Daily National Intelligencer* (Washington, D.C.), May 1, 1816, 3. Reporting on his observations through a telescope, "Z" speculates, for instance, that one particular sunspot cluster is about 40,000 miles across, and states that it looks like a cluster of islands such as the Bahamas.

[12]Ibid.; *Daily National Intelligencer* (Washington, D.C.), May 9, 1816, 3.

[13]*Montreal Gazette*, June 3, 1816, 2.

[14] Immanuel Velikovsky (1895-1979) was a Russian-born psychiatrist who argued that collisions or near-collisions of celestial objects with the Earth, including Venus, Jupiter and various comets, influenced various events in human history and prehistory. His theories were roundly rejected by mainstream science. The publication by a major publishing house of Velikovsky's infamous 1950 book *Worlds in Col-*

farmer penned an angry letter to a newspaper editor demanding that McClure withdraw his statements. This reader—who argued that sunspots were caused by transits of Mercury or Venus across the sun—fulminated that to believe God constructed the solar system so poorly that celestial objects were in danger of running into each other was blasphemy: "worse than Atheism itself, and no man can believe it without horror."[15]

The unique fascination that sunspots held for observers in 1816 is entirely understandable given the circumstances. Twenty-first century science usually explains sunspots as temporary localized areas of inhibited convection on the photosphere of the Sun, resulting in lower surface temperatures in those areas which appear to us as dark spots.[16] But there remains even today much misunderstanding, and even superstition, regarding sunspots. Modern literature, often denounced by experts as pseudoscience, continues to assert a connection between sunspot activity and climate change or weather events.[17] Indeed, sunspots are sometimes still asserted as a causal factor in the Year Without a Summer, mostly in pop culture pieces and on the Internet.[18] Today's popular

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lision triggered a controversy within and without the scientific community regarding the appropriate dividing line between science and pseudoscience.

[15]Letter to the Editor, *Green-Mountain Farmer* (Bennington, VT), May 18, 1816, 3. This writer, who signed his letter simply "A Farmer," might not have realized that it would have been easy enough to test whether this theory is true. Any common almanac available at the time included measurements and calculations of the exact positions of Mercury and Venus night after night, and extrapolating where they were during the day—and if they happened to transit the sun—would not have been difficult. *See, e.g., Miner's Pennsylvania and New Jersey Almanac for the Year of Our Lord 1816* (Doylestown, PA: Asher Miner, 1815).

[16]David Alexander, *The Sun* (Santa Barbara, CA: ABL CLIO, 2009), 69.

[17]*See, e.g.,* Rasmus E. Benestad, *Solar Activity and Earth's Climate* (New York: Springer-Verlag, 2006).

[18]Today, ironically, it is the *lack* of sunspots which is sometimes cited as a causal, or at least a contributing, factor. *See, e.g.*, Jeremy Ross, "Solar Activity Lowest in Almost 100 Years, Implications for Climate Potentially Significant," *SOTT.net*, April 9, 2009, http://www.sott.net/articles/show/181839 (accessed January 31, 2012). It is noteworthy that websites of this nature are sometimes associated with anthropogenic climate change denial. *See, e.g.*, R. John Muench, "Data Doesn't Support Global Warming Theory," *SOTT.net*, May 30, 2008, http://www.sott.net/articles/show/159029-Data-doesn-t-support-global-warming-theory (accessed January 31, 2012). The relationship between the Year Without

conceptions about sunspots have not strayed far from the parameters of the debates about them that occurred in 1816.

There is no way to gauge how widespread belief in the sunspot causation theory was among ordinary Americans in 1816, but some clues suggest a disconnect between the oft-repeated denials of the theory among the scientific elite, and what people really believed (or suspected). The sheer volume of articles refuting the sunspot causation theory seems to indicate that it had significant support in some sectors of the public, or at least that people were prepared to consider it. The diary of one Joseph Trumbull, written in an almanac, contains a curious note about sunspots, totally unlike anything else in his diary, which is overwhelmingly preoccupied with financial accounts and household tips. Yet opposite the page for May 1816—the very month when visible sunspot activity reached its maximum—he wrote:

> Solar Spots.
> It is a well known principle that an affect produced by the continued agency of any cause is not simultaneous with the agency; and the greatest effect is produced posterior in time to the greatest activity of the cause...Witness the greatest heat of the day is usually after the Sun passes the Meridian...the greatest heat of Summer after the Sun leaves the tropic the flood in the tides after the Moon makes the meridian...[19]

This passage might have been quoted, but Trumbull did not identify its source; nevertheless, its cryptic ruminations on causation of astronomical events, and the express identification of this idea being associated in his mind with sunspots, seems to indicate that Trumbull was thinking about sunspots as being the potential delayed cause of *something*. The curious weather events of that year had not yet begun to manifest

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a Summer and modern climate change denial is explored in Chapter VI.

[19]Joseph Trumbull, Diary, May 1816, Trumbull Family Papers 1773-1903, Mss. Octavo Vols. T, Vol. 6, American Antiquarian Society Archives, Worcester, MA.

themselves by May. The passage could have been written later in the summer and backdated to the month where Trumbull recalled sunspots—a potential cause—as being at their peak.

Americans' unusual preoccupation with sunspots in the spring and summer of 1816 gives rise to the question: if sunspots were not somehow involved with the weather anomalies, why did people think they were? Was there something special about sunspot activity at this time?

Sunspots wax and wane on an eleven-year cycle. Having been a subject of systematic scientific observation since at least 1611, the rise and fall of sunspots can be easily graphed and evaluated.[20] Examining such a graph, one sees that not only did 1816 fall on the down-slope of one of these cycles, but that year also occurred during a period called the "Dalton Minimum," a historically low interval of sunspots spanning much of the first third of the 19th century.[21] During the Year Without a Summer, sunspots were not only rarer than most other times during a normal eleven-year cycle, but even *less* numerous than usual due to the Dalton Minimum. Yet it is clear from contemporary accounts that people generally perceived that sunspots were at an all-time high. Why?

The answer—again—is Tambora. The sulfur dioxide in the air resulting from the eruption diffused light and caused a diminution in the general transparency of the atmosphere. Scientists have observed this effect by compiling and comparing eyewitness historical reports of lunar eclipses to determine how clear or occluded the atmosphere was. In this study, the lunar eclipse of June 1816, visible from London and New England,

[20]Karen C. Fox, "Celebrating 400 Years of Sunspot Observations," NASA Website, March 9, 2011, http://www.nasa.gov/mission_pages/sunearth/news/400yrs-spots.html (accessed February 2, 2012).

[21]Robert A. Rodhe, "400 Years of Sunspot Observations" (Graph), http://en.wikipedia.org/wiki/File:Sunspot_Numbers.png (accessed February 2, 2012).

is a remarkable outlier—"one of the darkest ever recorded," according to scientific literature.[22] Many contemporary reports speak of the sky having a hazy appearance, especially in May,[23] and reports of brilliant sunsets throughout the summer[24] also indicate hazy conditions. Simply put, the volcanic haze dimmed the atmosphere to the point where sunspots were visible to the naked eye to a much greater degree than they usually were. Sunspots were not more numerous, but because people could see them much more readily, many quite naturally assumed that there were more of them. Due to their unusual visibility, sunspots became an inevitable scapegoat for the weather anomalies.

B. Glaciers, Vapors and Musket Fire: Other Potential Causes

Shaky though its support was, sunspot activity was the only potential cause of the climate anomalies that commanded any significant degree of consensus. Americans did, however, occasionally advance other potential causes, some insightful, some ridiculous, and at least one that was somewhat close to the truth.

Aside from sunspots, global wind patterns were cited as a potential cause. "The extraordinary state of the weather," said a Connecticut newspaper, "is evidently caused by the prevalence of easterly and northerly winds blowing over the bleak, snow-clad mountains and islands of ice in the frozen regions of the north." The article raised the question of why wind patterns had been so different than usual but did not venture an

[22]Richard B. Stothers, "Stratospheric Transparency Derived from Total Lunar Eclipse Colors, 1801-1881," *Publications of the Astronomical Society of the Pacific* 117 (November 2005): 1446.

[23]*Daily National Intelligencer* (Washington, D.C.), May 1, 1816, 3.

[24]*American Beacon* (Norfolk, VA), September 9, 1816, 3.

answer.[25] Dr. Sturmer of Nuremberg, as mentioned above, generally thought the same, citing the general cause as "winds and vapours."[26] Winds blowing over glaciated and snow-covered terrain was a more prosaic and perhaps intellectually unsatisfying explanation, but at least it had the advantage of ascribing the weather events to a terrestrial cause.

In the midst of the cold summer there was no indication of how long the climate change event would last. Questions about whether the alterations were temporary or permanent in nature led almost inevitably to speculation that the Earth's climate, as a whole, was growing permanently colder.[27] The curious argument over whether the Earth's climate was gradually becoming cooler or warmer—"global cooling" versus "global warming"[28]—will be discussed more fully in Chapter VI, but it important to note that debates about causes were almost inseparably intertwined with questions or assumptions about the transience or permanence of the phenomena, as well as the degree to which human agency was culpable. The basic idea of human activity being capable of altering

[25]*Columbian Register* (New Haven, CT), July 27, 1816, 2.

[26]Ibid., September 3, 1816, 2.

[27]*See, e.g.*, Ibid., June 18, 1816, 2.

[28]The term "global warming" is, for those of us who live in the twenty-first century, a loaded term. For purposes of this paper I am using the term "global warming" to refer to the concept of the Earth's climate as a whole growing warmer, regardless of cause, and conversely, I will use the term "global cooling" to refer to the opposite effect. Both global warming and global cooling, in the way I am using these terms, are subsets of "climate change," which I define as a significant, non-transitory alteration in the climate patterns of the Earth, regardless of cause. Later, and particularly in Chapter VI, I will use the term "anthropogenic climate change" to refer to a climate change caused or at least greatly accelerated by human activity. The paradigm example of anthropogenic climate change is the current condition of the Earth's climate growing warmer as a result of pollution by carbon dioxide and other greenhouse gases from industrial processes, deforestation and other human causes. That is undoubtedly a form of global warming, but there is a tendency, at least among lay people, to interpret the term "global warming" (or "anthropogenic global warming," AGW) as referring *solely* to this modern example of climate change, which I feel is a misnomer.

planetary climate seems to have been less controversial than the specific activities that may have been to blame.

In the context of the global warming versus global cooling debate, another theory—perhaps better characterized as an observation rather than a theory—surfaced in a South Carolina newspaper. After a lengthy dissertation on climate change in general, the opinion of one Lord Dreghorn was given, relying principally on the testimony of a brewer who allegedly told him in 1784 that the global climate was even then growing colder, as attested by changes in the characteristics of barley. The changes began, according to Lord Dreghorn's brewer, in 1755, the year of the great earthquake in Lisbon. Dreghorn went on to say that the brewer's account was corroborated by reports from French wine makers that they had been unable to make the same varietals of wine since 1755, and they believed the Lisbon quake was somehow responsible.[29] The article did not explain the supposed linkage between the earthquake and climate change, but Dreghorn clearly asserted a causal relationship.[30] The 1755 Lisbon quake was a tremendous shock to the western world of the Enlightenment era and directly and indirectly motivated various efforts to better understand earth sciences.[31] Given the impact this event had on the psyche of the Atlantic world, it is not surprising that it was considered as a potential cause.

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[29]"Climate of the U. States," *Camden Gazette* (Camden, SC), September 12, 1816, 1.

[30]In another parallel between the Year Without a Summer and modern anthropogenic climate change, modern scientists are again asserting that such a link between climate change and tectonic activity exists; however, today's theories have the chain of causation reversed, i.e., anthropogenic climate change may be causing earthquakes rather than the other way around. *See, e.g.*, Agence France-Presse, "Climate Change Affects Tectonic Plate Movement, Causing Earthquakes: Study," *The Raw Story*, April 13, 2011, http://www.rawstory.com/rs/2011/04/13/climate-can-drive-seismic-shifts-study/ (accessed February 9, 2012).

[31]Jelle Zeilinga de Boer and Donald Theodore Sanders, *Earthquakes in Human History: The Far-Reaching Effects of Seismic Disruptions* (Princeton: Princeton University Press, 2005), 88.

One of the most creative causation arguments, and one that alleged human agency, linked the Year Without a Summer to the recent end of the Napoleonic Wars in Europe. An article reproduced in the *Daily National Intelligencer* referenced a treatise by an unnamed German writer entitled "The Effects of War Upon the Seasons," which asserted that there was a more or less permanent current of cold air flowing from the Arctic regions to the equator. This current could be directly affected by wars in Europe, to wit:

> [T]he concussion produced in the atmosphere by large and frequent discharges of gunpowder, obstructed this current, and often cause a current in an opposite direction. According to this writer, therefore, the prevailing coldness of this year, may be explained from the universal peace which at present pervades the nations of the European world.[32]

This theory seems absurd at first blush, but it has at least a spiritual kinship with modern scientific arguments on the effect of war upon the global environment. Indeed, the theory of a planet-killing "nuclear winter," popularized by astrophysicist and peace activist Carl Sagan in the 1980s, hypothesizes the effect of smoke from burning atom-bombed cities in the wake of a nuclear war as a larger and more pronounced version of precisely what Tambora did to the atmosphere in the nineteenth century.[33] The nuclear winter theory argues for global cooling as a result of war rather than peace, but the basic concept of climate change as a side effect of large-scale military conflict—and presumably its moral implications—was not unknown in 1816.

Speculations on the effect of smoke in the atmosphere led some, at least, to conclusions that landed remarkably close to the right answer. William Young, an educator who in the fall of 1816 had been elected to the New York state legislature, penned a letter

[32]*Daily National Intelligencer* (Washington, D.C.), September 3, 1816, 2.

[33]Paul J. Crutzen and John W. Birks, "The Atmosphere After a Nuclear War: Twilight at Noon," *Ambio* II, no. 2/3 (1982): 114-25.

expressing alarm at the forest fires that were raging in many parts of the Northeast in late September and early October, due in large measure to drought conditions. Young wrote of the fires: "I fear that the smoke which they produced, accumulating in the atmosphere, must intercept the rays of the sun, and deprive us of much of that genial heat of which the earth seems everywhere so much in want."[34] Young was elucidating, in colloquial terms, a theory of atmospheric cooling caused by particulates—which he could not have known was precisely what had already happened on a much larger scale and more distant cause than the particulates produced by the New England forest fires. This sort of reasoning, if considered in conjunction with speculations, some voiced by none other than Benjamin Franklin in the previous century, that volcanoes could produce atmospherically deleterious particles,[35] demonstrates that the various component pieces of the Tambora causation theory all existed in some nascent form at the time the climate anomalies were happening. All that was needed was someone to put the pieces together. In short, given the state of knowledge at the time, it would not have been surprising if scientific thinkers or even a lay person in 1816 had come up with an accurate scientific explanation for what was happening to their world. Whether such an explanation would have been generally accepted, however, is quite another matter.

C. Causation Arguments and the "Pastiche of Knowledge"

An admittedly unquantifiable—and possibly unscientific—impression that emerges from a broad survey of public debates about causation is a sense of bafflement. Despite the many opinions raised and circulated in various quarters, some acknowledging

[34]*Richmond Enquirer* (Richmond, VA), October 19, 1816, 4.

[35]See Chapter VII, note 35.

naked conjecture in the midst of others that purport to be the absolute truth, no single hypothesis seems to have commanded a significant consensus among the American public. Indeed the dynamic of the public discussion seems to indicate that the various causation opinions were more or less considered to be on an equal footing with one another, not in the sense of the number of adherents any one theory may have had (which is impossible to tell), but in the remarkable lack of competition for an implicit standard of legitimacy. Today, that implicit standard is scientific accuracy. Americans' discussions about climate anomalies in 1816, however, do not seem to presume that scientific accuracy was the bottom line. Particularly with regard to sunspots were, people did argue about what was scientifically accurate and what was not. However, scientifically accurate information does not seem to have been as impressive to Americans in 1816 as it would be today.

The various reactions to the climate events seem to indicate that the Year Without a Summer fell into what in many ways was a transitional period in how science was perceived as a means for explaining convincingly the processes of the physical world. Various writers' constant invocations of scientists, such as William Herschel or the mysterious Dr. Sturmer, show that learned scientific explanations could and probably did have some cachet. But 1816 was an era when *institutional* science—organized bodies of credentialed experts in carefully-delineated specialized fields, with common standards of proof and methodology—was in its infancy. Herschel had his views on what sunspots were and whether they were affecting the weather, but these views competed on a more or less equal playing field with the suppositions of Lord Dreghorn and his brewer. I believe this points in favor of a sort of uneasy coexistence in the public consciousness

between scientific understanding on the one hand, and knowledge derived from more common sources, such as the practical experience of farmers or artisans.

The attraction of practical and folk knowledge in this period is easily recognized in the profusion of “Farmer’s Almanac”-type publications, such as the very almanacs in which diarists recorded their thoughts about the strange events of that year. These pamphlets are filled with astronomical tables and authoritative-sounding weather predictions, but they are also rife with catchy verse, religious sayings, amusing anecdotes and common agricultural and household tips. Almanacs were the perfect embodiment of the character of the body of knowledge that informed Americans’ worldview about their environment: it is a curious pastiche composed partly of hard science, partly of superstition, seasoned with practical observation and animated by folklore. This “pastiche of knowledge”—to coin a term—was incomplete and self-contradictory, and it was also organic, changing over time as experience, particularly of practical field knowledge, expanded and grew more diverse. In contrast to our modern scientific or social scientific doctrines, which we view as the work of experts handing down their newly-minted wisdom from universities and research institutions, the pastiche of knowledge was a collaborative effort that involved the general public. Today we would call it “open source.” In addition to the farmers’ almanacs—every region had one or more published locally—newspapers in 1816 frequently ran, as front-page news, tips for seeding or harvesting crops, dealing with animals or general housekeeping. All of these contributions, whether from lay people or “philosophers,” mingled together in a nebulously-defined body of understanding that existed without gatekeepers, central direction, or even implied judgments of legitimacy or veracity.

This pastiche of knowledge directly shaped the environmental worldview of the people of 1816. Because it was an amalgam of knowledge derived from many sources, there was no particular expectation that it was infallible or complete. Consequently, the explanations for the natural world that derived from the pastiche of knowledge could not be considered authoritative, at least not in explaining extreme or unusual phenomena. One might expect, for example, that the advice in a farmer's almanac regarding the best time to harvest rye would be generally accurate, so long as conditions that season were consistent with past experience. In a year as wildly unpredictable as 1816, however, the same advice might well be disastrous. Could the pastiche of knowledge reasonably be expected to provide answers for such bizarre events? The reality that some things are inherently unexplainable was a key element of this worldview.

Nevertheless, peoples' reactions to the climate anomalies of 1816 demonstrate that, while they realized the limitations of such a worldview, these limitations made them uneasy. The search for answers to what was causing the phenomena clearly demonstrates the deep desire to understand and evaluate it, and the denialist tendencies of some people such as Warwick Palfray, Jr. indicate that uncertainty and incompleteness regarding natural phenomena was not always easy to accept. When one steps back and considers the early 19th century as a time of transition between a world of superstition and faith and the newly-emerging modern world of Enlightenment-guided science and reason, this tension between acceptance of the inexplicable and unease at the failure to explain it makes sense. The world of 1816 was not rocked to its foundations by the climate anomalies, but neither did it simply shrug them off and take no notice. This may be why the events have

been difficult to grasp in a historical context. At once they were earth-shaking, and at the same time they were ephemeral.

Seen in this sense, the sense of bafflement with which the world confronted the events of the Year Without a Summer seems to have been an entirely predictable and appropriate response. The pastiche of knowledge was not competent to explain everything, and while it assumed that there was much in the natural world that was inexplicable, that realization was on some level unsatisfying. The limitations of your worldview, even if you are aware of them, will not help you struggle through a hardscrabble winter after frost in August destroys the corn crop on which your economic prospects largely or wholly depend. With no readily identifiable agency to blame, even asking why seems strangely academic. Yet many Americans did ask why, and they came up with a wide array of possible answers. The act of questioning was itself a significant response. Sometimes questions carry more meaning than answers.

CHAPTER IV

"A GREAT PARTY QUESTION": POLITICAL RAMIFICATIONS

A. Political Trends: Moribund Federalists and Sullen Voters

By the physical accidents of the timing of Tambora's eruption and the conditions in the atmosphere that carried its blanket of disaster across the globe, the Year Without a Summer happened to fall within an election year in the United States. There is no question that the climate events had some impact on politics or were at least interpreted by some in political contexts. The only question is what impacts the events had. This is, necessarily, a very difficult question to answer; what is surprising, however, is how few historians have chosen even to ask it.

As political contests go, 1816 is not generally regarded as particularly pivotal. That autumn, James Monroe, the "last of the Founders," won the presidency in his own right with minimal Federalist opposition, and he would replace the retiring James Madison in March.[1] The congressional, gubernatorial and local elections resulted in the continuation of large Democratic-Republican majorities at both national and state levels of government—not a surprising outcome, given the traditional historical analysis that the Federalist party was suffering its final *Götterdämmerung* as a result of its opposition to the War of 1812.[2] As 1816 was not politically noteworthy, there has been little incentive to analyze the climate anomalies in a political context. Indeed, as any evidence linking

[1]Noble E. Cunningham, Jr., *The Presidency of James Monroe* (Lawrence, KS: University Press of Kansas, 1996), 15-26.

[2]Shaw Livermore, Jr., *The Twilight of Federalism: The Disintegration of the Federalist Party 1815-1830* (Princeton: Princeton University Press, 1962), 11-46.

climate and weather to political sentiment is necessarily speculative and conjectural, virtually no historians have thus far made an attempt to do so.

One exception is C. Edward Skeen, who advances one example of the weather events' impact upon politics. The most contentious national political issue of 1816 was the "Compensation Law," a federal act to raise the salary of Congressmen, which had not been adjusted since 1789. Portions of the bill were retroactive, meaning Congressmen would receive significant sums up-front. After a contentious debate in the House and Senate, the bill passed and was signed into law by President Madison on March 19. The idea of federal representatives, most of them already wealthy gentlemen, raising their own salaries retroactively outraged the public, and a colossal furor played out on the nation's newspaper editorial pages—and at the ballot boxes.[3] Angry voters threw out nearly seventy percent of the incumbent members of Congress in the fall elections, a record high turnover that still stands today.[4] Chastened by their defeats, after the elections the lame-duck Congress quickly repealed the offending law. Skeen argues that "[t]he outrage of the citizenry over this act was undoubtedly fanned by the general malaise created by crop failures and threatened famine."[5] This is probably true. However, focusing on a single political result—however dramatic—as a potential effect of the weather anomalies overlooks the myriad other political or politically-influenced responses which are admittedly much more diffuse but possibly more representative of peoples' reactions to the events.

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[3]Skeen, 77-91.

[4]By contrast, in 1994, a modern Congressional election generally regarded as a significant political sea change, less than 7% of incumbents were defeated. Office of the Clerk, U.S. House of Representatives, "Statistics of the Congressional Election of November 8, 1994," http://clerk.house.gov/member_info/electioninfo/1994/94Stat.htm (accessed February 15, 2012).

[5]Skeen, 13.

B. The Linchpin Issue: Harvests and Food Security

An important clue to how to begin evaluating the political impact of the Year Without a Summer comes from the correspondence of John Quincy Adams, concerning, not American, but British politics. In a letter to his mother on August 30, 1816, Adams, after describing the dismal weather in England and predicting that harvests would not be abundant, noted:

> I have been surprised to find that from the beginning of [August], it has been here a great party question whether the harvest of this present year would be good or bad. Cobbett, who is the literary representative of the reformers...announced that [the harvest] would be scanty. Mr. Hunt, another ardent reformer...pledged his honor that it would be bad. But all the newspapers, ministerial and oppositionist, Whig and Tory, have opened in full cry against these predictions...[T]his question is made a subject of acrimonious party discussion...all the ruling parties in this country...have agreed that most of the distresses now weighing down this country are owing to excessive plenty...while no small part of their population are nearly perishing with famine.[6]

Adams here clearly identifies the linchpin issue underlying the political debates in England: food security. In 1816 most people in the United States and across the world depended on subsistence agriculture for their livelihood. Naturally, whether harvests would be good or bad was a paramount concern everywhere. The political landscape was obviously different in England than in the United States, but, as the climate anomalies manifested themselves in more or less the same magnitude on either side of the Atlantic, the question becomes fair: were concerns about the effect of the climate anomalies on harvests interpreted in the United States, as they seem to have been in England, in partisan political terms? In order to answer this question, we must investigate what

[6] John Quincy Adams to Abigail Adams, August 30, 1816, *Writings* IV: 77-78.

people in the United States were saying about harvests, and whether there is any evidence that political orientation may have influenced these opinions.

The subject of harvests was easily the most-discussed potential impact of the climate anomalies. It was a topic of public conversation everywhere in the United States, with mention of the subject increasing sharply in late August and September as traditional harvest times approached. On September 13, a Virginia newspaper reported that corn crops would be one-half to two-thirds short, and lamented that "[t]he cold as well as the drought has nipt the buds of hope."[7] Another Virginia paper in mid-August gave capsule predictions of the likely harvests for a laundry list of crops, from hay, flax and oats to potatoes, cherries and apples, some of which would be favorable, while others damaged by cold and drought would be "uncommonly short."[8] Other people were more optimistic. In New Haven, Connecticut, a newspaper declared brightly that "reports of scanty crops have been very exaggerated or entirely unfounded."[9] In Georgia, which suffered less from cold and weather shocks than many parts of the country, corn and cotton were described as having "never been better,"[10] while a Boston newspaper savaged those who predicted short harvests, warning them "not lightly to prejudge the ways of Providence...*Peace and Plenty*."[11] Clearly, whether a harvest would be good or bad depended heavily on the particular crop, local weather conditions and other non-weather

[7]"Crops," *American Beacon* (Norfolk, VA), September 13, 1816, 3.

[8]*Richmond Enquirer* (Richmond, VA), August 14, 1816, 4.

[9]*Columbian Register* (New Haven, CT), August 9, 1816, 2.

[10]*Georgia Journal* (Milledgeville, GA), July 17, 1816, 3.

[11]*New-England Palladium & Commercial Advertiser* (Boston, MA), August 20, 1816, 1.

factors such as the presence or absence of flies or other pests.[12] But some trends involving political affiliation are faintly discernible in some sources.

In 1816, newspapers were the key bellwether of politics. The era of fierce political partisanship between the Federalists and the Democratic-Republicans, which had begun in the 1790s, had not quite run its course by 1816, and newspaper editors were still the foot-soldiers of political parties.[13] Newspapers usually attracted and retained their readers on the basis of their openly-acknowledged political affiliations. The Washington, D.C. *Daily National Intelligencer*, for example, was one of the most influential newspapers in the country precisely because of its close connections with Democratic-Republican politicians, and in fact it was regarded as a semi-official mouthpiece for the Madison administration.[14] Conversely, Federalist newspapers such as Boston's *New-England Palladium & Commercial Advertiser* did their best to keep alive the fading spark of the opposition party in the gloomy winter of public scorn that followed New England Federalists' ill-advised Hartford Convention of 1814, which had, in many peoples' minds, crossed the line from reasoned opposition to the War of 1812 to outright sedition.[15] Virtually nothing that happened in the United States that was worthy of public attention escaped comment by the sharply-honed party press machinery. If, therefore, there were

[12]It is certainly conceivable that in some areas the weather anomalies might have directly affected populations of invasive or helpful insects and thus had an effect upon crops. Consideration of this potential effect is beyond the scope of this paper.

[13]Jeffrey L. Pasley, *The Tyranny of Printers: Newspaper Politics in the Early American Republic* (Charlottesville: University Press of Virginia, 2001), 1-23.

[14]Carol Sue Humphreys, *The Press of the Young Republic, 1783-1833* (Westport, CT: Greenwood Press, 1996), 75.

[15]Donald R. Hickey, *The War of 1812: A Forgotten Conflict* (Urbana, IL: University of Illinois Press, 1989), 255-80.

political dimensions to the climate change events, we can expect to see them reflected in these newspapers.

It is helpful to divide newspaper comment on the climate events, and particularly the effects on harvests, into two categories. What can be termed "harvest downbeat" stories would usually report a weather event or related crop damage, and then add a gloomy prediction about harvests in general. A typical example comes from the *American Beacon* of Norfolk, Virginia, a Democratic-Republican paper, reporting on frosts in Cape May, New Jersey, in late June:

> In this place we had hard frost five successive nights...The farmer's prospects are at present quite unpromising here, as the vegitable [sic] kingdom has suffered exceedingly by the uncommon course of the season...[N]ot a green leaf is to be seen for acres together...The oldest person here has no recollection of a like season.[16]

By contrast, "harvest upbeat" stories less often conveyed hard news about specific weather events. They usually took a reactive tone, responding to reports of crop failures or predictions that harvests would be short; the message was invariably that the reality would not turn out to be as bad as feared. This representative example comes from the *Columbian Register* of New Haven, also Democratic, from early August:

> A gentleman, who travelled over the northern and western parts of this state [Connecticut], as well as through New-Jersey, informs us that the crops in general are very good; that wheat is abundant, and corn, potatoes, &c &c, look very well. We believe that reports of scanty crops have been very exaggerated or entirely unfounded.[17]

"Harvest upbeat" and "harvest downbeat" stories were not mutually exclusive. Papers sometimes took an equivocal tone, acknowledging shortages in one crop or area,

[16] *American Beacon* (Norfolk, VA), Vol. II, Issue 124 (July 4, 1816), 3.

[17] *Columbian Register* (New Haven, CT), August 9, 1816, 2.

while expressing hope that another crop or locality was unaffected or would yield bountiful results.[18] Reporting on harvests was also inconsistent. It is rare to find a newspaper that consistently took either an upbeat or downbeat approach for most of its harvest reporting, although one such example can be identified.[19] Given the irregular patterns of which papers were being published, in what cities, and which of those papers have yielded relevant and accessible source material that has survived into modern times, there can be no pretense that any given sample of news sources is comprehensive, representative or totally free of selection bias. Nevertheless, quantitative analysis yields some potentially instructive results.

Consider a pool of sixty-three news items, selected largely at random,[20] published nationwide between May 4 and October 16, 1816 that can be fairly characterized as "harvest upbeat," "harvest downbeat," or both. Of this total, forty-five were published in papers that were solidly Democratic-Republican and the remainder, eighteen, solidly Federalist. Of these totals, forty items from Democratic-Republican papers and seventeen from Federalist papers are unequivocal—meaning, they cannot be classified as expressing both "harvest upbeat" and "harvest downbeat" sentiments in the same piece.

Of the Democratic-Republican reports, 52.5% were "harvest upbeat" and 47.5% "harvest downbeat." This suggests that the split between optimistic and pessimistic harvest predictions was generally small. However, the numbers are much more

[18]*See, e.g.*, *Richmond Enquirer* (Richmond, VA), October 12, 1816, 2 (reporting that corn is short, but rye and wheat "are abundant, and sufficient, we apprehend, for the consumption of the people.")

[19]See next section.

[20]By *largely* at random I mean that my only criteria in selecting them was that (1) the source was available to me in my research, and (2) the source contained a story that fit either the "harvest upbeat" or "harvest downbeat" model. I made no effort to favor (or disfavor) newspapers of any particular political persuasion or city. My research in general focuses more on New England simply because there are more sources available there.

interesting on the Federalist side. When Federalist newspapers within this selection made comments on the harvest, 35.3% could be characterized as “harvest upbeat,” while nearly two-thirds—64.7%—were “harvest downbeat” stories. Within this sample, then, it appears that writers for Federalist papers were almost twice as likely to express unequivocal pessimistic opinions on the harvest than were their counterparts at Democratic-Republican presses. A very narrow majority of Democratic-Republican news items are optimistic about the harvests, while the Federalists who took that view number barely more than a third.

This spot-check survey cannot be regarded as conclusive. However, it demonstrates that the notion of political affiliation affecting peoples’ estimation of the impact of the climate events, at least in agricultural terms, may be more than pure conjecture. In the absence of sophisticated modern polling data, informal surveys of this kind may be the best we can do.

Why might political party affiliation have affected these perceptions? Why were harvests and food security an explicit political issue in Britain, and at least a potential one in the United States?

The obvious answer is that harvests and food security posed a latent threat to political stability, and political leaders understood this chain of causation all too well. The evidence is quite explicit in Great Britain. The failure of crops in 1816, caused in large measure by the weather anomalies, triggered a serious subsistence crisis in many parts of Europe, which manifested itself in Britain in the form of demonstrations and riots by working-class people who had been severely harmed by the rising prices of food staples. In February 1817 the British government suspended the right of habeas corpus, and June

saw the "Pentrich Revolution," an abortive attempt by radicals to take over the town of Nottingham.[21] Revolutionary flare-ups of this nature did not occur in the United States, but not because food security was significantly greater. Indeed the winter and spring of 1816-17 was a lean one for many Americans, particularly in New England, with wheat and corn prices spiking in the face of severely decreased yields.[22] Europe was, in 1816-17, recovering from nearly twenty years of war, and agitation for liberal political reforms, a long-term manifestation of French Revolutionary ideas, roiled under the surface of nearly every European country.[23] This was not true in the United States, forty years removed from a revolution designed to institute a liberal political order, and only a year following the end of its second war with Great Britain to preserve that revolution. Therefore, it makes sense that Americans' responses to food insecurity would be markedly different than those observed in Europe.

Ruminations on the impact of party affiliation on the severity of impacts aside, it is clear that poor harvests and the possibility of food insecurity translating into bread riots or other political discontent did not become an explicit political issue in the United States. Indeed, governmental response to the climate events and their effects was minimal. In the winter of 1816-17 a few tepid petitions were introduced to Congress, some requesting a temporary ban on export of foodstuffs, and others more vaguely suggesting that committees study if government measures were necessary to alleviate distress from crop failures. None of these petitions got out of committee.[24] No reference

[21]Post, 84-85.

[22]Stommel, *Volcano Weather*, 81-87.

[23]Eric J. Hobsbawn, *The Age of Revolution: Europe, 1789-1848* (London: Weidenfield and Nicolson, 1962).

[24]Stommel, *Volcano Weather*, 87.

to food shortages or anything similar appears in the public papers of James Madison as he prepared that winter to leave the presidency. This is not surprising. In 1816-17 there was no general perception that ameliorating the effects of poor harvests or addressing food insecurity was the business of government at any level. Many Americans responded by pulling up stakes and moving west. Ohio was an especially popular destination; in late 1816 roads into the state were choked with wagons carrying settlers to what they hoped were more bountiful agricultural lands than they had left behind in New England.[25] Westward migration was itself a form of political response. Since Thomas Jefferson's election in 1801, the idea of an American "Empire of Liberty," spreading west and Americanizing the wilderness, had been a cornerstone of Democratic-Republican political thought as well as social engineering.[26] Ironically, in that sense, the climate events of 1816 helped to advance the ideological interests of the ruling party, instead of undercutting them as they seem to have done in Britain and elsewhere in Europe.

C. Climate Change Denial: The Strange Case of the *Essex Register*

We have seen in our own time that issues involving climate and climate change can become heavily politicized.[27] This seems to have been true in 1816. One newspaper, the *Essex Register* of Salem, Massachusetts, a rabidly pro-Democratic-Republican press, stands alone in its treatment of the climate change events of that year. While most newspapers were not consistent enough in their presentation of "harvest upbeat" versus

[25]Skeen, 13.

[26]Gordon S. Wood, *Empire of Liberty: A History of the Early Republic, 1789-1815* (Oxford: Oxford University Press, 2009), 357-399.

[27]*See, e.g., The Great Global Warming Swindle* (2007), directed by Martin Durkin.

"harvest downbeat" stories to warrant an inference of conscious editorial choice to slant the issue one way or another, the *Essex Register*'s incessant drumbeat of optimistic news stories seems to indicate that its editor had a very strong opinion on the matter that he wanted others to share. This newspaper did not express its views in explicitly political terms. Nevertheless, its virtual denial of what was happening in the summer of 1816 intuitively seems appropriate to consider in a political context, given what we have seen about the possible propensity to interpret the climate change events through a lens of political partisanship.

The *Register*'s first comment on the weather of the summer appeared on June 29. "Our very cold weather," it noted, "has been succeeded with such warm weather as gave us 90 degrees of Fahrenheit's thermometer within doors." It went on to remark blithely, "The account will be balanced probably before the season is ended."[28] A week or so later it charged boldly into the global warming vs. global cooling debate[29] by declaring "[t]hat the whole Atmosphere of the Globe has not become colder," on the basis of a single article reporting a plague in Greece that was supposedly caused by an uncommonly mild winter.[30] Later in July the *Register* noted that "the northern [harvest] is not so desperate as represented,"[31] and repeatedly predicted that both corn and potatoes would do well.[32] Twice within the same week, at the end of July, the paper glowed that the harvest would

[28]*Essex Register* (Salem, MA), June 29, 1816, 3.

[29]See Chapter VI.

[30]*Essex Register* (Salem, MA), July 6, 1816, 1.

[31]Ibid., July 20, 1816, 2.

[32]Ibid.,; Ibid., July 27, 1816, 3.

be “beyond our most sanguine expectations,”[33] then that “[w]e hear from every quarter more favorable opinions of the season.”[34] These rosy predictions continued unabated through the end of August, though the language of optimism becomes increasingly more general. On August 28: “[T]he demand of our prudence will be safe to our economy and to our eventual prosperity.”[35] The *Register* even hailed the September hurricane as good news, calling it “very favourable” and assuring the world that “[w]e are not suffering in this neighborhood.”[36] On the rare occasions the paper did admit that a certain crop was short, the news was invariably couched with statements that the harvests in general would be plentiful and abundant.[37]

If these uncommonly cheery reports stood alone, it might be regarded as merely a curiosity. However, the *Essex Register* went further in its reporting, evincing what can be characterized as nothing else but active denial of the facts. It is clear that, on the North American continent, climate-related impacts were the most severe in Canada. There are reports that a snowstorm deposited three feet of snow in parts of Quebec on June 27 and that lakes remained still frozen from winter in mid-July.[38] Weather-related grain shortages in Canada were already pinching by July, and the price of flour spiked to over $20 per barrel, when it could be procured at all.[39] The situation was so severe that the British government of Lower Canada province enacted a total embargo on wheat, flour, grains or

[33]Ibid.

[34]Ibid., July 31, 1816, 3.

[35]Ibid., August 28, 1816, 2.

[36]Ibid., September 23, 1816, 2.

[37]Ibid., July 27, 1816, 3.

[38]*Columbian Register* (New Haven, CT), October 12, 1816, 2.

[39]Ibid., July 27, 1816, 2.

anything that could be used to make bread.[40] Yet in early August, the *Essex Register* calmly reported that in Canada, "lately the season had been uncommonly favorable."[41] The *Register* was absolutely alone in this view. No other newspaper seems to have opined that the situation in Canada was anything other than dire.

Furthermore, the *Essex Register* ran other articles pushing back against claims, assumptions and fears about the coldness of the season. Some items made the argument with subtlety, while others were frontal assaults. In the latter category, the *Register* tried to prove with temperature measurements that the summer was not that much cooler, statistically, than previous seasons. Comparing temperature measurements in Washington, D.C., and Salem for July 1816 to the Julys of 1815 and 1814, the *Register* concluded that there was "a difference of one twelfth in the mean heat of the two places, and of one thirteenth in the two seasons at Salem, but only of a twenty third in the year before that."[42] In the subtler category, the *Register* ran an article on mortality, stating that "[t]the general health is a subject of congratulation." Again using statistical comparisons—this time involving bills of mortality from New York, Philadelphia and Baltimore—the article showed that deaths from "consumptions," presumably tuberculosis, declined slightly between 1815 and 1816. Linking this effect specifically to weather, the article stated, "The excellent season we now enjoy has put an end to all the murmurs we heard in the last month of Spring and the first of summer, and we are in good hopes the year will end with blessings."[43]

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[40]"Embargo in Canada," *Daily National Intelligencer* (Washington, D.C.), July 27, 1816, 2.

[41]*Essex Register* (Salem, MA), August 3, 1816, 4.

[42]Ibid., August 10, 1816, 2.

[43]Ibid., August 7, 1816, 2.

Most telling is the tepid concession the *Register* made in mid-October, after the disappointing harvests were in and the façade of denial could no longer be maintained without equivocation. A short article admitted that harvests in various places were "extremely various." However, the article ends with a sort of damning with faint praise: "We trust when we settle the year's account, it will not be the worst ever known."[44]

The editor of the *Essex Register* was one Warwick Palfray, Jr., an avowed Democratic-Republican. He had become the editor of the paper (then called the *Salem Register*) in 1805, replacing William Carlton who had died. Carlton was locally famous for having established a proudly Democratic-Republican paper in staunchly Federalist Salem in May 1800, when the bitter Jefferson-Adams presidential contest was heating up. Palfray worked as a journeyman printer at the paper before he became the editor. He later went into politics—while still editing the paper—and was elected to several terms as a Massachusetts state representative. He would continue as the *Register*'s editor until his death in 1838.[45] Palfray's personal stamp on his newspaper was marked. The second page of the paper usually contained a long editorial, written by Palfray himself, opining on whatever subjects he deemed relevant that day. As we will see,[46] in these editorials Palfray had some strong opinions on the subject of global climate change. The conclusion that he personally directed the *Register*'s reporting of weather and climate-related stories, or at least that it was done at his direction, is a reasonable one.

We can only speculate on Palfray's reasons for his hostility to the notion that the summer of 1816 was anomalous or that it would result in bad harvests and reduced crop

[44]Ibid., October 16, 1816, 1.

[45]Palsey, 210, 221-22.

[46]See Chapter VI, notes 20-21.

yields. The possibility that they were politically-motivated cannot be ruled out. What is noteworthy is the similarity of Palfray's arguments, and his paper's reporting, to contemporary examples of climate change denial. Modern skeptics of anthropogenic climate change frequently cherry-pick temperature data from individual places, as the *Register* did in its comparison of the summers of 1816, 1815 and 1814, to argue that modern warming trends are less severe than scientific consensus has predicted;[47] they have also claimed, again as the *Register* did, that mortality trends from infectious diseases tend to show that global warming is not happening.[48] Furthermore, the consistency and intractability of the *Register* on the issue of climate and harvests even in the face of conflicting evidence reflects similar result-driven consistency of modern climate change skeptics, which from all appearances is ideologically-motivated.[49]

The case of the *Essex Register* demonstrates that the climate anomalies of 1816 carried implications that were deeply disturbing to some people. While fear of the political and social repercussions of bad harvests and food insecurity is an educated guess as to the motivation behind the tendency to downplay the severity of the events, it is unlikely to be the whole story. Americans' reactions to the Year Without a Summer were complex and often contradictory. The *Essex Register* is but one example.

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[47]*See, e.g.*, James Taylor, "Carbon Dioxide Emissions Are Up Sharply, Yet Temperatures Are Flat?", *Forbes* (Online), November 11, 2011, http://www.forbes.com/sites/jamestaylor/2011/11/09/carbon-dioxide-emissions-up-sharply-yet-temperatures-are-flat/ (visited February 21, 2012).

[48]*See, e.g*, Ronald Bailey, "Matt Ridley's Rousing Defense of Climate Change Skepticism," *Reason.com*, November 4, 2011, http://reason.com/blog/2011/11/04/matt-ridleys-rousing-defense-of-climate (visited May 4, 2012).

[49]*See, e.g.*, Charles W. Schmidt, "A Closer Look at Climate Change Skepticism," *Environmental Health Perspectives* 118, no. 12 (December 2010): 536.

D. Putting on a Happy Face: Humor and Jokes

Although the weather in the summer of 1816 was often gloomy and sometimes downright alarming, reactions to it were not uniformly negative. Some Americans chose to poke fun at the events or the issues surrounding them. Not all of these humorous expressions were colored by political expressions, but enough were to warrant a brief discussion of humor in a political context.

Needless to say, humor in 1816 was somewhat arcane by modern standards. Appreciating the full impact of jokes, especially political ones, often requires a considerable breadth of knowledge not only in the contemporary political situation but in the bodies of knowledge, especially classical literature, that politically-active people in 1816 drew upon as a common basis. Take, for example, this joke from the Democratic-Republican *Columbia Register* of New Haven, Connecticut, which appeared shortly after the hurricane of early September:

> During the last Wednesday and Thursday we have been favored with rain in abundance....We have yet heard of no damage being sustained, excepting the destruction of a few packages of [Federalist] electioneering handbills—and a chilling damp to federal prospects on Monday next....[C]urious observers in natural history, although no Almanac makers, predict a sudden and rapid growth of scions in the political nursery about this time, that will be almost as wonderful as a host of Cadmus's men springing from the earth.[50]

The punch line of the joke is the notion that the only thing harmed by the weather is the fortunes of the Federalist party. Obliquely this can be read as a reassurance that the harvests will not be so bad as predicted. Cadmus was a Greek hero, the founder of Thebes, who sowed dragon's teeth in the earth from which sprang a race of fierce

[50]*Columbian Register* (New Haven, CT), September 14, 1816, 3.

warriors, the Spartoí, said to be the children of Ares. The reference to "scions in the political nursery" and the comparison to a mythological army of warriors may express the idea that the disappearance of the Federalists as a potent force in state politics will enervate Democratic-Republican voters and bode well for the party's long-term program for Connecticut and the nation.

Another Democratic-Republican paper, the *Green-Mountain Farmer* of Bennington, Vermont, joked about the sunspot phenomenon while ribbing the opposition party:

> We have some fears that [sunspots] will extinguish the Vermont luminary next September, and cover the state with darkness...that part of it which looks toward Washington has a peculiar blackness. We are somewhat fearful that the creators of this darkness, will put their own lights out, or be obliged to hoist BLUE ones; but we still hope they will soon set to work, rub off their RUST and brighten up again. If not we may think it our duty to join others in rubbing it off for them.[51]

Like the *Columbia Register* joke, this passage adopts a dismissive tone regarding the true practical impact of the climate anomalies, suggesting that it may be a tool of cosmic retribution for backing the wrong political party. In any event, it mocks both the sunspot hysteria and Federalists in general. The reference to colors is not entirely clear. The concept of "rub[bing] off their rust" may be a suggestion that Federalists are like old, decaying metal, whose entrenchment in the ways of the past can be wiped away by conversion to Democratic-Republican principles.

A writer to an Albany, New York newspaper, in a letter reprinted in the Madison administration's *de facto* mouthpiece, used the weather events and the debate over global warming versus global cooling to raise the specter of an unfinished aspiration of the War

[51]*Green-Mountain Farmer* (Bennington, VT), June 3, 1816, 2 (emphasis in original).

of 1812: the conquest of British-held Canada. “It seems very strange to me,” wrote the correspondent, identified merely as H.G.S., “that ever since our late ‘just and necessary war,’ those Canadian winds have all blown cold upon us.” H.G.S. joked that if Canada was the source of the cooling, either the United States must conquer it, “or we must all migrate southward in a very few years.”[52] This same issue of the *Daily National Intelligencer* presented the bizarre theory that the lack of musket fire occasioned by peace in Europe may have been the cause of the weather anomalies—an article that, in conjunction with H.G.S.’s letter, may have been intended in jest.[53]

Sunspots were a particular source of mirth, whether expressly connected to a political context or not. Even the *Daily National Intelligencer*, whose anonymous writer “Z.” flung so much ink at its pages regarding sunspots, was not above picking fun at the subject. A joke article published in September announced that the “disorder” afflicting the Sun was “*spotted fever*,” but then: “We are happy to state that His Highness is upon the recovery.”[54] Referring to the infamous “Bologna prophecy,” which foretold that sunspots supposedly causing the weather anomalies would ultimately mean the end of the world,[55] a Virginia paper quoted “an old miser” who was supposedly glad to hear the sun would soon be extinguished, “for then *property would doubtless be got at a bargain!*”[56]

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[52]*Daily National Intelligencer* (Washington, D.C.), September 3, 1816, 2.

[53]See Chapter III, note 32.

[54]*Daily National Intelligencer* (Washington, D.C.), September 9, 1816, 2. “His Highness” is presumably British heir apparent and regent George IV, about whose social life articles frequently appeared in American newspapers in the summer of 1816. If this joke seems somewhat unsatisfying to us today, consider that puns had a far greater appreciation as humor in the early 19th century than they do 200 years later.

[55]See Chapter V, Section A.

[56]*American Beacon* (Norfolk, VA), August 21, 1816, 3 (emphasis in original).

Reactions such as these fit comfortably with our own contemporary expectations of how people could be expected to deal with weather events of the severity, strangeness and potentially disastrous implications as those of 1816. Scientific, religious, or political issues aside, if the Year Without a Summer happened to recur today, who could not imagine the phenomena being rich fodder for *The Daily Show* or *Saturday Night Live?* Humor is a comfortable defense mechanism. Especially when something is puzzling or inexplicable, a common and quite natural reaction is to laugh at it.

E. Political Dimensions Considered: An Incomplete Picture

There can be no single or predominant answer to the question of how the climate anomalies of 1816 affected politics, or how political views affected perceptions of the events. Even to search for a single or clearly identifiable political effect ignores the rich complexity of how these events affected Americans and the myriad ways in which they reacted. Some Americans worried about the coming harvest. Others were unconcerned. Some voted with their feet and moved west. Others denied the events were happening. Others still made jokes. Perhaps the extraordinary voter revolt over the Compensation Law was somehow tied to the climate anomalies; perhaps not. Necessarily this is an incomplete picture.

The main point to be made is that there is evidence that the climate events did have some political repercussions, however diffuse. The suggestion of a very weak correlation between party affiliation and perception of the severity of the climate impacts is one argument for this political dimension. Another is the resemblance of the *Essex Register*'s stance of denial to arguments raised in contemporary climate change discourse,

which no one would deny contains a fundamental political component.[57] The exploitation of the climate anomalies and related issues for purposes of political humor is another small mark on the canvas of an incomplete and murky picture of how these events resonated throughout the United States. If we are to understand the Year Without a Summer in its proper context, we must acknowledge its political dimensions, however faint and inscrutable they may be.

[57] It is true that contemporary denial of anthropogenic climate change is driven, at least to some extent, by the efforts of industry lobbies and business interests to inject a coloring of doubt into the public discourse about climate change. That clearly is a difference between today's climate debates and those of 1816; however, the point made in this chapter regards the structure and narrative of denialist arguments, which one can evaluate independently of the motivations for creating them.

CHAPTER V

"END OF THE WORLD WEATHER":

APOCALYPSE, RELIGION AND FEAR

A. Apocalypse: The Bologna Prophecy

In the summer of 1816, English poet Samuel Taylor Coleridge, then living in Highgate, England and trying to conquer an opium addiction,[1] had been in ill health. In mid-July he wrote to a friend, "I have had no *relapse* for three weeks: tho' I have been otherwise unwell twice—and this *end of the World* Weather is sadly against me...".[2] He was not the only European literati to think of the climate events in 1816 in apocalyptic terms, whether seriously, in jest, or in artistic context. Coleridge's friend Lord Byron, who spent much of that summer vacationing at the Villa Diodati on the shores of Lake Geneva in Switzerland, composed a poem called "Darkness," which speaks vaguely of the end of the world occasioned from the extinguishing of the sun.[3] His housemate at the Villa Diodati, Mary Wollstonecraft Shelley, had also been influenced by the climate events. She wrote later that the gloom of that "wet, ungenial summer," and the ghost stories that she and her companions told each other to amuse themselves while being cooped up indoors, inspired her classic novel *Frankenstein*.[4]

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[1]Basil Willey, *Samuel Taylor Coleridge* (W.W. Norton & Co., 1972), 174

[2] Samuel Taylor Coleridge to J.J. Morgan, July 17, 1816, in *Collected Letters of Samuel Taylor Coleridge*, ed. Earl Leslie Griggs (Oxford: Clarendon Press, 1959), IV: 660.

[3]Jeffrey Vail, "The Bright Sun Was Extinguish'd': The Bologna Prophecy and Byron's 'Darkness,'" *The Wordsworth Circle* XXVIII, No. 3 (Summer 1997): 183-92.

[4]Mary Wollstonecraft Shelley, *Frankenstein, or The Modern Prometheus, The Original Two-Volume Novel of 1816-1817 from the Bodleian Library Manuscripts* (Oxford: Bodleian Library, 2008), 439. The origin of *Frankenstein*, which was hatched at the same time as Poledouri's *Vampyr*, has had an interesting resonance in popular culture. At least two horror films have been made dramatizing the events at the

There is no record of any apocalyptic predictions associated with the climate events that fostered wide belief in the United States. That was not the case, however, in Europe. As the *London Times* reported in late June, running an item from an unnamed French paper dated June 1:

> According to the calculations of an astronomer of Bologna, who has lately published here [in Fermo, Italy] some observations on the subject, on the 18th of July a great solar catastrophe is to put an end to the world by conflagration. The signs of this are the spots to be remarked at present on the sun's disk. The government, thinking it improper to suffer the circulation of such predictions, has put the astronomer under arrest.[5]

Information on the origin of the "Bologna Prophecy" is surprisingly scant. It is not known precisely who made the prediction, or if he was really an astronomer, and when or under what circumstances the prophecy was made. As it was on the minds of Europeans by June 1, before the sustained assault of unseasonably wintry weather through the summer, the prediction was likely made months or perhaps even years earlier, but then became incorporated into narratives involving sunspots and the weather anomalies. The *London Times* noted the conflation of the prophecy with weather and sunspot lore, remarking that "[t]hese spots are said to be the cause of the remarkable and wet weather we have had this Summer, and the increase [in sunspots] is represented to announce a general removal of heat from the globe, the extinction of nature, and the end of the world."[6] Whatever was the Bologna prophet's rationale for choosing July 18 as the date of doomsday, it undoubtedly resonated with these narratives perfectly. In modern terms

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Villa Diodati in the summer of 1816: *Gothic* (1986), directed by Ken Russell, and *Haunted Summer* (1988), directed by Ivan Passer. Furthermore, the controversial novel *Haunted* by iconic author Chuck Palahniuk features a modern redress of the Diodati-and-*Frankenstein* genesis legend. Chuck Palahniuk, *Haunted* (New York: Doubleday, 2005).

[5]*London Times* June 2, 1816, 3.

[6]Ibid., July 19, 1816, 70.

we could characterize the Bologna Prophecy as having "gone viral," at least in Europe, though word of it was also widely circulated in the United States.[7] To believers its plausibility could be confirmed by a mere glance at the sun and observation of the dreadful weather.

The prophecy deeply frightened many people. In London, one Eleanor Saunders, a sixty-two-year-old domestic servant, was so terrified of doomsday that she hanged herself. This incident was noteworthy enough to be reported in newspapers in New York City,[8] and mention of it found its way into John Quincy Adams's diary for July 19, the day after the predicted doomsday. "The effect and agitation of [the prophecy] story," Adams wrote on that day, "have been very considerable, both in France and England. The churches and chapels have been unusually crowded."[9] London newspapers also reported a story about a woman from Somersetshire who believed in the prophecy and tried, without success, to cause younger members of her family to believe it as well. One morning when a little girl of the household ran into the woman's bedchamber crying, perhaps as a joke, "The world's at an end!" the woman was supposedly struck by fear into a catatonic state.[10] In various communities in Belgium, fear of the Bologna Prophecy drove large crowds of people, mostly women, into churches "to prepare themselves against this dreadful catastrophe."[11]

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[7]John Quincy Adams, discussing the Bologna Prophecy in a letter to his mother, prefaces it with the words, "as you must have heard," indicating that knowledge of the prediction (if not belief in its truth) was widespread on both sides of the Atlantic. John Quincy Adams to Abigail Adams, September 20, 1816, *Writings* VI: 90.

[8]*New-York Weekly Museum* (New York, NY), October 19, 1816, 366.

[9]Adams, Diary, July 19, 1816, *Memoirs* III:404-05.

[10]*London Times*, July 23, 1816, 3.

[11]*New York Courier*, August 30, 1816, 2.

Learned people reacted to panic over the Bologna Prophecy with chagrin. “Such is human credulity!” lamented John Quincy Adams.[12] A writer in the *Essex Register*, perhaps Warwick Palfray himself, commented regarding the Bologna Prophecy that “all the fears of superstition are of the same nature, and the slave of one easily becomes the slave of another.”[13] In a New York paper, a writer commented on Eleanor Saunders’s suicide, wondering why, if the world was going to end anyway, she thought that denying herself the grace of God by committing the sin of suicide was a preferable way to enter the afterlife. Another commenter rebuked him, noting that “he is asking the question as a sane, reasoning person, whereas [Saunders] had lost that sanity which would have enabled her to see it in the same point of view.”[14]

Some tried actively to stamp out belief in the Bologna Prophecy. Some authority, whether civil or ecclesiastical, seems to have arrested the original Bologna astronomer who made the prediction, evidently on charges of disturbing the peace.[15] In France, an astronomer named Rouy published an open letter in the Paris newspapers refuting the prophecy.[16] In the week leading up to the supposed doomsday, M. Rouy advertised that he would give public lectures about sunspots “in order to convince the credulous, that there need be no fear of the extinction of that luminary.”[17] Protestations that the Bologna Prophecy was false assumed much the same character as more general assertions, unconnected to specific apocalyptic predictions, that sunspots were harmless.

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[12]Adams, Diary, July 19, 1816, *Memoirs* III:405.

[13]*Essex Register* (Salem, MA), August 17, 1816, 2.

[14]*American* (New York, NY), September 4, 1816, 2.

[15]*Essex Register* (Salem, MA), August 17, 1816, 2.

[16]*American* (New York, NY), September 4, 1816, 2.

[17]*American Beacon* (Norfolk, VA), September 9, 1816, 2.

The Bologna Prophecy was by no means the only doomsday prediction circulating during the summer of 1816. Others, perhaps copycats, seemed eager to get in on the action:

> In Naples, as in most of the cities in Italy, there have lately been prophets who predicted the end of the world. In the beginning of June, a priest named Carillo, preaching in the church of St. James, announced that the city of Naples would be destroyed on the 27th of that month. It was to rain fire for four hours—and those who escaped the fire were to be devoured by serpents...[T]he police were compelled to arrest the prophet and several other individuals.[18]

Constant talk of the end of the world had people on edge. On July 11, in Ghent, Belgium, a regiment of cavalry happened to be on maneuvers at the same time a thunderstorm struck. The roar of thunder combined with the cavalry's bugle calls for retreat frightened the townspeople, who streamed into the streets in a panic. "The *good folks* of Ghent, persuaded that the end of the world was at hand," said one newspaper, "believed they had heard the *Seventh Trumpet*, which, according to *Revelations*...is to announce the *last judgment.*"[19] In the United States, a group of Shakers, said to be influenced by "a pretended prophet," began buying up large quantities of grain in anticipation of a famine that would last seven years—reminiscent of various seven-year famines mentioned in the Bible.[20] In addition to illustrating apprehensions about the end of the world, these reaction show that many people were inclined to interpret the events of that summer and the rumors about them in a religious context, to which we turn our attention next.

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[18]*Repertory* (Boston, MA), September 7, 1816, 1.

[19]*London Times*, July 23, 1816, 3.

[20]*Essex Register* (Salem, MA), August 3, 1816, 3.

B. Crowding the Churches: Religious Reactions

As with politics, it is difficult to quantify the religious impact of the Year Without a Summer. Although the Bologna Prophecy was evidently not couched explicitly in religious terms, the panic in Ghent on July 11 indicates that some people sought to define their fears of the end of the world in the context of religious eschatology. Much more frequent in contemporary accounts, however, are references to people appealing to God directly, either for forbearance from the dreadful weather events, or amelioration of their effects, especially upon the harvest.

Quincy Adams' mention of unusually crowded churches in England[21] was mirrored in many other places. In Sweden, where crops were also failing, people crammed into churches to offer daily prayers to God to stop the unfavorable weather.[22] Church attendance in New Hampshire increased too, and observers noted with approval that "[a]n improved state of religious society became strikingly evident."[23] In other parts of New England, such as Brandon, Vermont, the weather and its effects upon the harvest drove increased attendance at religious conference meetings, some of them cutting across denominational lines.[24] The desire to beseech God for deliverance from the weather appears in Thanksgiving proclamations from that autumn, which were both a religious and political ritual in the United States. New Hampshire Governor William Plumer's

[21]Adams, Diary, July 19, 1816, *Memoirs* III:404.

[22]*Columbian Register* (New Haven, CT), September 21, 1816, 2.

[23]John Milton Whiton, *Sketches of the History of New-Hampshire From its Settlement in 1623 to 1833: Comprising Notices of the Memorable Events and Interesting Incidents of a Period of Two Hundred and Ten Years* (Concord: Marsh, Capen and Lyon, 1834), 189.

[24]Joshua Bradley, *Accounts of Religious Revivals in Many Parts of the United States from 1815 to 1818* (Wheaton, IL: Richard Owen Roberts, 1980), 138.

proclamation, for instance, noted that in 1816 "the earth has not yielded her usual supply for our returning wants," and stated that it was the duty of the people "to humble ourselves for our transgressions, and to practice that righteousness which exalts and renders a nation prosperous."[25]

The religious reaction to the climate anomalies, at least in the United States, is typified by an account of the small town of Poultney, Vermont. Joshua Bradley, a minister from Albany, New York, published in 1819 a volume of anecdotes regarding religious revivals of the past few years. Describing the story of Poultney, Bradley stated:

> In 1816 an uncommon gloom spread over that whole state. The season was truly alarming, and every month through the year was whitened with frost or snow. This severe judgment seemed to produce a solemnity upon the minds of the multitudes...In [September], a work of grace began in one corner of the town. The pious were held in a state of suspense, between hope and fear, whether, it would continue and spread its blessings, or take its flight, and leave the people in their sins.[26]

This question as to the collective spiritual fate of Poultney, Bradley recorded, was settled by the sudden simultaneous religious epiphanies of several young girls who were "suddenly struck with solemn awe." The girls, overwhelmed by the holy spirit, retired to a house to read the Bible and soon began spreading the message of Christian salvation through the rest of the town.[27] This anecdote is interesting for a number of reasons. For one thing it illustrates the idea of human spiritual action—the redoubling of religious fervor—as a direct and appropriate response to the weather events and crop failures. For another, it emphasizes the collective nature of both the curse and the cure; the story is not

[25]*Boston Independent Chronicle*, October 10, 1816, 2.

[26]Bradley, 130-31.

[27]Ibid., 131-32.

about the personal salvation of the girls, but how they became agents of redemption of the *entire community*, which was affected equally by the weather. Finally, it does not end with an explicit affirmation of the material effect of this spiritual awakening. We do not know from Bradley's account if the bad weather abated or if the next year's harvest was improved, though we assume it must have been. The happy ending is not about the amelioration of the weather or harvest conditions, but about the collective spiritual improvement of the character of the town. These undercurrents—improvement of the world through human spiritual solutions, implemented largely on a collective level—became key themes in the Second Great Awakening.

The Year Without a Summer itself proved to be formative in the life of one of the major figures of the Second Great Awakening. The climate anomalies of that summer struck the hardscrabble farm of the Smith family in Norwich, Vermont, especially hard. Their previous two attempts at establishing a prosperous farm in New England had been thwarted by crop failures in 1814 and 1815. The strange cold summer and the crop failure it caused—their third in a row—nearly wiped them out. "This was enough," wrote Lucy Smith. "My husband was now altogether decided upon going to New York." That fall of 1816 the Smith family removed to Palmyra, New York, which two decades later would become famed as the "Burned-Over District" seared by religious revivals. The Smiths' eleven-year-old son, Joseph Jr., would fail there too, first at running his family's farm and then as a treasure hunter; but his claims of having discovered the Golden Plates ultimately triggered the most enduring legacy of the Second Great Awakening: the Mormon religion.[28]

[28] Richard Lyman Bushman and Jed Woodworth, *Joseph Smith, Rough Stone Rolling* (New York: Alfred A. Knopf, 2006), 27-32.

Religious reaction to the climate events of 1816 was different in Europe than it was in the United States. On the continent, as we have seen with certain reactions to the Bologna Prophecy, increased religious fervor tended to take a more eschatological, or at least quasi-eschatological, form. In Austria, where rains and flooding had caused severe food shortages, a Catholic priest named Pöschl gathered a modest following that demanded equality and community of property, and believed that a thousand-year period of peace and plenty would soon be at hand. Austrian authorities, paranoid of any spark of revolutionary spirit, arrested Pöschl and eighty-six of his disciples.[29] In Switzerland, a similar sect anticipated the imminent return of Christ, which was presaged by the climatic conditions and attendant famine. "The Rhine rots with corpses," wrote Baroness Julie de Krüdener, the sect's leader. "Misery is rampant...The time is approaching when the Lord of Lords will reassume the reins."[30] These sorts of reactions call upon the personal intervention of God rather than the spiritual awakening (or reawakening) of people, but they share a common thread. Whether as the cause of the Year Without a Summer or the cure of its ills, people who reacted in a religious context clearly saw the agency of God in these events as direct and self-evident.

C. Emotional Reactions: Gloom and Melancholy

These reactions—religious fervor, belief in eschatology and apocalypse, and the seeking of solace from environmental dangers in religion—are closely intertwined. What pervades all of them, sometimes mentioned explicitly, other times lurking beneath the

[29]Post, 96-97.

[30]Ibid. (citing Ernest J. Knapton, *The Lady of the Holy Alliance: The Life of Julie de Krüdener* (New York: Columbia University Press, 1939), 178)).

surface, is a marked sense of gloom, melancholy and fear. It is well-understood in our modern world that weather trends affect the moods and psychology of the public.[31] This was no less true in 1816 than it is today, and people who lived through such an extraordinary climatological event could not have avoided being affected by it.

Faithful diarists who wrote every day, or nearly every day, provide an interesting road map of the rise and fall of their moods and emotions over the summer. Thomas Robbins, a pastor in South Windsor, Connecticut, often included comment on the weather in his diary entries, and these inclusions provide an interesting means of tracking his emotional states in tandem with weather trends. In April and May, while his diary frequently noted drought conditions and expressed concern for them, he seems to have delved into a deep funk. Watching a woman die right in front of him on May 3 may have exacerbated his gloomy feelings.[32] "Devoted a considerable part of the day," he wrote on May 14, "to meditation and prayer under my severe trials."[33] He commented on May 29, a cold day, that "Our churches generally are in a pretty cold state."[34] Through the ups and downs of June and July Robbins kept careful track of the weather and harvest prospects, about which he was obviously concerned. In late August he noted that his congregation "had a very solemn and interesting season of prayer on account of the drought." The very next day, when rain came, his entry was very upbeat, crediting the blessing of God for the deliverance. Just three days later, when frosts struck at the end of August, his spirits

[31]Stephen J. Lurie, M.D., Ph.D., Barbara Gawinski, Ph.D., Deborah Pierce, M.D., M.P.H., and Sally Rousseau, M.S.W., "Seasonal Affective Disorder," *American Family Physician* 74, no. 9 (November 2006): 1521-1524.

[32]Thomas Robbins, *Diary of Thomas Robbins, D.D., 1796-1854*, ed. Increase N. Tarbox (Boston: Beacon Press, 1886), I: 665.

[33]Ibid., 668.

[34]Ibid., 669.

plunged again: “It is a melancholy time. There was a fast here yesterday on account of the season.”[35] Not long after he recorded another “solemn season of prayer” for relief from the drought.[36]

The words that Robbins chose to describe weather events are telling. In entries between May 10 and September 24, comments on negative weather events and his own moods include terms like *distressed, concerned, afflictions, great trials, melancholy, alarming,* and even *evil*. The word Robbins repeated most often in this period was *severe*, appearing several times in the context of both weather and emotional states.[37] Another word that does double duty is *season*—as shown above, Robbins used it to refer to an outpouring of prayer, but he also often used it in its conventional sense, i.e., “Very cold for the season.”[38] These trends, though very subtle, seem to suggest that Robbins perceived—perhaps even subconsciously—a relationship between the weather events, his own personal trials, and religious and spiritual responses.

In the multitude of various reactions to the Year Without a Summer it is difficult to separate gloom and melancholy from outright fear. Newspapers often spoke of fear in terms of harvest predictions, for instance, “*fearing* a scarcity.”[39] But fear in general was on some peoples’ minds, even without being connected specifically to a looming apocalypse. Diarist William Jenison recorded the early June snowstorm in New England

[35]Ibid., 677.

[36]Ibid., 679.

[37]Ibid., 668-681.

[38]Ibid., 673.

[39]*Daily National Intelligencer* (Washington, D.C.), July 27, 1816, 2 (emphasis added).

by stating: “Considerable flurry of snow fell in Boston to scare the people.”[40] In Philadelphia, “cold and fear” were spoken of as being pervasive by late September.[41] In most instances people seemed to know what they were afraid of: failing crops, animal die-offs or other specific results that could threaten economic well-being. In these more isolated cases, however, the subject of fear seems to stand alone.

In the absence of medical statistics comparable to the breadth of records kept today, we cannot know how profoundly the emotional, spiritual and psychological effects of the climate anomalies affected various communities. We do, however, have some tantalizing bits of evidence to suggest that melancholy, depression and fear were marked during the summer of 1816. In addition to the evidence presented above regarding church attendance, increased religious fervor and general feelings of malaise and apprehension, there is some indication that suicide rates were unusually high. “The Paris Papers remark the increase of suicides in the Netherlands and in Naples,” noted a Boston newspaper. “The same increase has been observed in every country in Europe, England excepted.”[42] No such indication can be found for the United States, but given the trends observed in American sources, an increase in people taking their own lives during the middle months of 1816 would certainly not be surprising.

D. Cultural and Spiritual Reactions Considered: Confirming Intuition

The climate anomalies of 1816 defy easy description. They were complex, various, contradictory and puzzling. It is therefore entirely predictable that cultural,

[40]Jenison, Diary, June 8, 1816.

[41]*Essex Register* (Salem, MA), September 11, 1816, 2.

[42]*Intelligencer* (Boston, MA), September 14, 1816, 1.

spiritual and personal reactions to them would be as complex, puzzling and difficult to conceptualize as the phenomena must have seemed at the time. Lord Byron, Eleanor Saunders and the young girls of Poultney, Vermont all experienced the strange season in different contexts and from different perspectives. Byron responded by writing a poem called “Darkness.” The girls of Poultney responded by proselytizing for Christ. Eleanor Saunders responded by putting her own head into a noose. Each of these reactions represents the culmination of a fabulously complex set of individual motivations and perceptions. The difficulty in categorizing or finding commonalities in these reactions reflects, in a way, the central mystery about them: people simply did not know what to make of them. There was no accepted framework of interpretation, a level ground from which responses could depart. Merely noting the wide variation of cultural and spiritual responses is almost the best we can do.

It is clear, however, that the climate anomalies *did* affect people in ways both subtle and profound. Eleanor Saunders’s suicide lies at perhaps the most extreme pole of spiritual reaction. At the other pole we have the terse diary entries of Thomas Robbins, suggesting a sort of pall or malaise that can only be discerned from careful examination of his words. What cannot be ignored is that the Year Without a Summer did demand reaction and response to a degree significantly greater than ambient climate conditions. It was an extraordinary event; the reactions it engendered were also extraordinary, even if they weren’t always spectacular or even immediately apparent.

The various reactions catalogued here indicate that the climate events of the Year Without a Summer cast an uncomfortable pall of gloom, fear and apprehension across many parts of the United States and Europe. Doomsday panics do not flourish when the

public is generally content and untroubled; church attendance does not swell markedly in short periods of time when people are optimistic and complacent. Intuition tells us this, and historical experience bears it out. One of the reasons why reactions were so varied is that the institutions with which humans try to explain the wider processes of the world around them—churches, for instance, or scientific establishments—could not offer any satisfying answers to why the anomalies were happening or what should be done about them. The Year Without a Summer found the world somewhat baffled, and left it in much the same state.

CHAPTER VI

"OUT OF THE ORDINARY COURSE OF THINGS":

GLOBAL WARMING VS. GLOBAL COOLING

A. Conceptions of Climate Change Pre-1816

In the early nineteenth century, before the balkanization of scientific opinion into a myriad of insular and often mutually-exclusive subfields, an educated man with a background in any learned discipline could lay legitimate claim to being a scientific expert. Such a man was Hugh Williamson, M.D., L.L.D., member of the Holland Society of Sciences, the Society of Arts and Sciences of Utretcht, and the American Philosophical Society.[1] In a book on subjects as wide-ranging as climate science, racial theories and the history of Native Americans in North Carolina, Dr. Williamson opined that the climate of the United States was growing warmer. "It is generally admitted," he wrote, "that in Massachusetts and New-Hampshire, the quantity of snow that fell, during the winter, fifty years ago, was more than double of what has fallen, in any winter, for several years past." He also cited observations that certain American rivers no longer froze in the winter, as they had done half a century before. Furthermore, this change was not limited to North America: warmer climates had also affected prevailing winds across the oceans, evidenced by the fact that ships could make the crossing from Europe in one-third less time than they had before. The cause of these climate changes, according to Dr.

[1] Hugh Williamson, *Observations on the Climate in Different Parts of America, Compared with the climate in corresponding parts of the other continent. To which are added remarks on the different complexions of the human race; with some account of the aborigines of America. Being an introductory discourse to the history of North-Carolina* (New York: J.T. & Swords, 1811), ix.

Williamson, was clearing and cultivation of forested land by humans.[2] His book was published in 1811, five years before the Year Without a Summer.

From the vantage point of the early twenty-first century, we would recognize Williamson's theory as remarkably prescient. He was describing a potentially global climate change driven primarily by human activity—a theory of anthropogenic global warming. Williamson's theory was not new in 1811. He had been espousing similar theories at least forty years before. He was not alone. As early as 1721, Cotton Mather had observed that New England winters had become milder as a result of deforestation, and in 1763, Benjamin Franklin suggested much the same thing.[3] These observations and theories evinced an awareness that the activity of human beings, collective and cumulative, was capable of changing the climate of the planet, decades before the world's first internal combustion engine sputtered furtively to life.

Thomas Jefferson, who could lay no less legitimate claim to scientific expert status than Williamson could by the standards of the time, also believed in anthropogenic global warming. In his famous *Notes on the State of Virginia* he observed that winters in his home state had become milder in years past, winter temperatures less severe, and frost-related crop failures less frequent. Like Williamson, he believed the chief cause of this climate change was the clearing and cultivation of lands and the encroachment of settlement.[4] Most of his observations about what climate had been like in the past were

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[2] Ibid., 9-10.

[3] James Rodger Fleming, *Historical Perspectives on Climate Change* (New York: Oxford University Press, 1998), 24-25.

[4] Thomas Jefferson, "Notes on the State of Virginia," in *The Portable Thomas Jefferson*, ed. Merrill D. Peterson (New York: Penguin Books, 1975), 118-19.

based on anecdotal evidence rather than more systematically gathered empirical data. He wrote in 1785:

> A change in our climate is taking place very sensibly. Both heats and colds have become much more moderate within the memory even of the middle-aged…[The snows] are remembered to have been formerly frequent, deep and of long continuance. The elderly inform me the earth used to be covered with snow about three months in every year.[5]

The almost bemused observational tone of Jefferson's notes on Virginia's climate dimly reflect his likely indifference to, or perhaps even optimism about, the effects of climate change. He couched his conception of the agency of climate change in terms that mirrored his own certainty about the expansion of American civilization westward into the frontier. Regarding the patterns of moisture-bearing winds, he noted that "[a]s the lands become more cleared, it is probable they will extend still further westward."[6] Dr. Williamson was even more explicit about both the beneficial effects of anthropogenic global warming and the development of that phenomenon in tandem with American political liberty. He contended that a moderately warming climate would stimulate scientific and political development of the American people:

> [I]t is certain, that in the progress of settlement, when the face of the country is cleared, the American atmosphere will become more pure, for it will be less charged with vegetable exhalations. The pure state of the atmosphere must have a considerable effect upon the temper and genius of the inhabitants…I should venture with confidence to predict that…the American states, in a few ages, would not shrink from a comparison with the Grecian republics, or any other people in recorded history.[7]

[5] Ibid., 119-20.

[6] Ibid., 116.

[7] Williamson, 175-78.

The Williamson/Jefferson theory of anthropogenic global warming did not go unchallenged. The most vocal critic of the theory was Noah Webster, who in 1799 penned an essay "On the Supposed Change in the Temperature of Winter." Webster argued that the main determinant of climate temperature was sunlight absorbed by the Earth from the sun, and if the inclination of the Earth's axis has not changed appreciably in modern times, there was no reason to suggest that climate would be getting warmer (or, presumably, colder either). He particularly criticized the use of anecdotal evidence such as the recollections by elderly people of what climate had been like in the past. If clearing and cultivation did have an effect, Webster contended, it was probably to redistribute heat and cold, but not increase or decrease it in absolute terms.[8] Webster's rejection of anthropogenic global warming was shared by others, such as Dr. Johann David Schoepf, a Hessian doctor who attacked the theory in his book *The Climate and Diseases of America During the Revolution*. Explorer and naturalist William Dunbar, who often corresponded with Jefferson on scientific matters, took the critique a step farther by suggesting that clearing and cultivation might actually make winters colder by allowing the freer circulation of Arctic air.[9] In an era before widespread systematic empirical weather observations generated a reliable body of climate data to draw from, in the early nineteenth century debates over anthropogenic climate change were largely academic, incapable of being supported or refuted with a substantial degree of persuasiveness. It was mostly just anecdotes and arguments among disinterested parties.

[8] Fleming, 45-47.

[9] Ibid., 31-32.

B. The Debate of 1816: Global Warming vs. Global Cooling

With the subject of climate change an open question at the time, it was inevitable that the weather anomalies of the Year Without a Summer would change the debate in America about climate. How the anomalies should be interpreted in a broader climatic context became a very public conversation during the summer of 1816.

Prior to 1816 it was difficult to find a coherent argument that the Earth as a whole was growing cooler—as opposed to merely a critique of the global warming theory or a supposition that *winters* were growing cooler.[10] When the anomalies of the Year Without a Summer struck, however, one previously obscure assertion of global cooling was suddenly rediscovered. As discussed earlier, several newspapers became interested in the observations of one "Lord Dreghorn," who argued on the basis of the testimony of his brewer that the Earth was growing colder, not warmer.[11] "Lord Dreghorn" was in fact John MacLaurin, the Earl of Dreghorn, a Scottish jurist who had published a book in 1798 that dealt mostly with British legal history. Lord Dreghorn's views on climate change were contained in a brief but fascinating essay toward the end of the book. In addition to reporting that his brewer told him in 1784 that changes in the cultivation of barley indicated global cooling, Lord Dreghorn conjectured, drawing upon other anecdotal sources, that the ultimate cause of the cooling had something to do with the Libson earthquake of 1755.[12] Lord Dreghorn's views were published in various places

[10] It is important to note that both Noah Webster and William Dunbar stopped short of arguing that the Earth's climate *as a whole* was becoming cooler. The typical view of anti-warming thinkers seemed to be that, if the severity of one season was affected, it was typically balanced by a roughly equal severity in an opposite season—thus, hotter summers might be balanced by colder winters and vice-versa.

[11] *Camden Gazette* (Camden, SC), September 12, 1816, 1.

[12] John MacLaurin, *The Works of the Late John MacLaurin, Esq., of Dreghorn: One of the Senators of the College of Justice* (Edinburgh: J. Ruthven and Sons, 1798) II:302-03.

throughout the summer, but they seem to have found their way first into New England papers in mid-June, right after the freak snowstorm. A Connecticut newspaper quoted the essay, but added this curious antecedent suggesting that Lord Dreghorn's account had attained new relevance given the recent weather shocks:

> The Weather is a constant subject of remark, and we have often heard speculations on a supposed change in the character of the Seasons, when probably nothing really extraordinary attended them. Winter always "lingers in the lap of May"—but now we have its chilling breath even in June. On this subject we find the following curious article in a curious book...[13]

Lord Dreghorn's essay, together with this suggestive antecedent, also appeared verbatim in the *Daily National Intelligencer*. Interestingly, the article appeared in conjunction with another essay denouncing the sunspot causation thesis of the climate anomalies. Taken together, the two articles seem to suggest that, if sunspots were not causing the summer's curious weather, an overall trend of global cooling might be to blame.[14] Indeed the *Daily National Intelligencer* tended toward advancing global cooling theories. It was in its pages that appeared, in mid-September, the inventive idea already discussed that the end of the Napoleonic Wars in Europe and the subsequent absence of large clouds of smoke from musket fire were arresting a global warming trend.[15]

A more empirical argument for global cooling emerged from a Virginia newspaper in late September. It took a much more persuasive tone, though its supposed scientific bases would be recognized as nonsense today. The unnamed writer argued that the temperature of the Earth's climate was attributable to three main factors: solar radiation;

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[13] *Connecticut Journal* (New Haven, CT), June 18, 1816, 2.

[14] *Daily National Intelligencer* (Washington, D.C.), August 27, 1816, 2.

[15] Ibid., September 3, 1816, 2.

the "internal heat" of the Earth (presumably, geothermal heat, or heat left over from the Earth's initial creation); and "the circulation of the electrical fluid through the Atmosphere." It was an imbalance in this "electrical fluid" that was supposedly the main cause of the summer's strange weather, but, aside from that, the editorial argued that Earth was growing colder in general. The evidence used to support this claim included a book that asserted the climate of Sweden had once been much warmer than it now was, the discovery of fossils of tropical creatures in Denmark, and the supposed "historical fact" that Greenland had once been lush, verdant and capable of supporting a large population.[16] Like Lord Dreghorn, the editorial suggested a potential link between earthquakes and climate, arguing that the "electrical fluid" was somehow thrown out of balance during periods of increased seismic activity.[17] The Year Without a Summer occurred only four years after the powerful New Madrid earthquake of 1812, and someone predisposed to believe in a link between seismic activity and climate change might well conclude that earthquakes were on the rise as a general trend.

Defenders of the traditional Williamson/Jefferson theory of anthropogenic global warming fired back. Another lengthy editorial, originally attributed to the *Virginia Compiler*, began to appear in various papers in September. "It needs 'no ghost from the grave,'" the editorial began, "to satisfy us that our climate has undergone, and is

[16] "On the Cold of the Present Season," *Lynchburg Press* (Lynchburg, VA), September 26, 1816, 2. Ironically the "Greenland used to be green" argument is used today by deniers of anthropogenic global warming. To reach this conclusion they rely chiefly on the island's name, which they contend was a term of literal description given to it by medieval Norse explorers. The argument is erroneous. The ice sheet covering Greenland is at least 400,000 years old, and while Norse settlement did occur during the "Medieval Warm Period," the Vikings found the island only marginally more habitable than it is today. The name "Greenland" may have been a deliberate misnomer employed by Erik the Red, who hoped that a name suggesting lush conditions might attract more potential settlers. "Greenland Used to be Green," *Skeptical Science*, http://www.skepticalscience.com/greenland-used-to-be-green.htm (accessed April 5, 2012).

[17] "On the Cold of the Present Season," *Lynchburg Press*, September 26, 1816, 2.

undergoing several changes." The article argued that global warming was verifiable fact, mining historical accounts for relevant examples that Europe was much colder in the past, such as accounts of the Danube freezing solid enough to serve as an ice road or reindeer frolicking in the Black Forest of Germany. While conceding that the summer of 1816 had indeed been "out of the ordinary course of things," the anonymous author cast the events of the summer as an extreme outlier from which a general trend should not be extrapolated:

> We must regard these things in a general point of view, without descending to all the particulars. We must take the rule and not the exception. We must not suppose from any one year's being cool, that our climate was becoming so; for it is not every swallow that makes a summer; it is not every variation that constitutes the general principle. We must have an eye to a long succession of seasons…[18]

In this way the editorial uses the very strangeness of the weather anomalies as an argument for why jumping to a conclusion of global cooling is premature. Climate change presumably proceeds at a slow pace; if the Earth was indeed getting colder, would it not be so that each season would be only slightly colder than the one before, such that people would tend not to notice it unless they were looking back over a long span of time? "No one is surprised at what is common—it is a thing's being *extra*-ordinary that makes us wonder at it."[19] In modern terms we might call this a "boiling frog" argument, predicated on the notion that a frog thrown into boiling water will leap out and save its life, whereas a frog in a pot where the water temperature is rising slowly and steadily will not notice the incremental change and thus boil to death.

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[18] *New-England Palladium & Commercial Advertiser* (Boston, MA), September 8, 1816, 2.

[19] Ibid.

Not surprisingly, a staunch defender of the global warming theory was Warwick Palfray, Jr.'s *Essex Register*. In its zeal to deny that climate anomalies were occurring, or that, if they were, they were nothing to be concerned about, the Salem, Massachusetts paper was predictably hostile to the idea of global cooling. Early in July the *Register* ran a front-page story declaring "[t]hat the whole Atmosphere of the Globe has not become colder, we may conjecture from an article respecting the plague at Smyrna." The newspaper attributed the appearance of the disease in that city "to an uncommonly mild winter, or rather hardly any winter at all."[20] The article's author did not attempt to explain how the mildness of winter in one specific city should be judged indicative of macro-scale global climate trends. Nevertheless, the *Register* was eager to go on record in the climate change debate. Later in July the paper published its longest commentary yet regarding the weather anomalies. In addition to attacking the sunspot causation theory, the *Register*'s lengthy editorial attempted a forceful critique of the global cooling thesis through a technique calculated to appeal to erudite readers: an examination of ancient history from classical sources.

The *Register*'s editorial lauded a writer called Meilhan, whose 1813 book—its title is not given—included a chapter "on the people of the north." Melihan had evidently criticized other writers, most notably the seventeenth-century Swedish doctor and scientist Olaus Rudbeck, who maintained that the Earth had been growing steadily colder since antiquity. Rudbeck had claimed that the lost civilization of Atlantis had actually existed in modern-day Sweden, thus suggesting that Scandinavia had once been much warmer. Employing the common trope of measuring how "enlightened" various peoples

[20] *Essex Register* (Salem, MA), July 6, 1816, 1.

were to each other, the editorial pointed out the lack of evidence for global cooling from an anthropological perspective:

> If the Globe grows colder, this can only be by degrees, and a cold, increasing insensibly, destroys not entire races of men….The inhabitants of the countries which experience this change of temperatures, must retire little by little, to those in which the cold is less sensible, and must necessarily preserve the knowledge, sciences and arts which distinguished the other people. It would result from this progressive movement, that the…Laplanders would be still at this day the most enlightened people.[21]

The assumption that peoples generally migrate toward areas of warming was taken for granted.[22] While professing to keep an open mind about global warming or global cooling, the writer of the *Register*'s editorial challenged, perhaps rhetorically, anyone to come forward and explain the prehistoric migration of peoples between Northern Asia and North America, presumably a reference to the "land bridge" theory. Summing up anthropogenic global warming, the editorial noted that "one of our best philosophers has produced facts for the increasing heat of American as well as European climate, from changes made by settlements upon the surface of the globe by the clearing of lands."[23]

One newspaper, the South Carolina *Camden Gazette*, endeavored to make sense of the debate as well as to examine the Year Without a Summer as a whole, on a macro level. On September 12 there appeared in this paper possibly the longest single feature run in an American newspaper on the climate anomalies that summer, absorbing nearly three of four columns on the front page. Entitled "Climate of the U. States," the article

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[21] *Essex Register* (Salem, MA), July 24, 1816, 2.

[22] The assumption, typical of nineteenth century speculations on ancient history, does not account for why Eskimos remain in certain areas of the Arctic.

[23] Ibid.

began with a consideration of global climate, accepting as a fact that the Earth had generally become warmer since Roman times. In support of this view the author asserted that snow fell in Italy in ancient times, and the Crimea then had a climate not unlike Siberia.[24] Yet the editorial admitted the possibility that perhaps this trend had reversed, noting that "since 1812, the seasons have been very unlike what they formerly had been." The editorial launched into a litany of weather anomalies from across the United States, from the New England snowstorm to mass animal die-offs in Quebec, the sharp frosts, droughts, and crop failures. Interestingly, the editorial mentioned the hailstorm in Westchester, Pennsylvania on July 2, which had allegedly dropped stones from the sky. The writer also mentioned the sunspot causation theory—without committing himself or herself to asserting its truth or falsity—and quoted Lord Dreghorn's essay about his brewer and the Lisbon earthquake.[25] By both asserting the literal truth of historical global warming *and* suggesting strongly that the planet had begun to cool noticeably since 1812, the *Camden Gazette* constructed a new narrative that essentially split the difference between the two theories: yes, global warming *was* a fact, but the climate is now moving in the opposite direction.

What did this climate change mean, and what were its potential consequences? As to this question the *Camden Gazette* editorial was unabashedly optimistic:

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[24] "Climate of the U. States," *Camden Gazette* (Camden, SC), September 12, 1816, 1. These asserted facts were likely derived from the work of Samuel Williams, one of the leading anthropogenic global warming theorists, whose 1794 book *Natural and Civil History of Vermont* argued that the ambient temperature of Italy had risen about seventeen degrees since the time of the Caesars. Williams got there by surveying Roman literature for references to weather. This approach was one of the elements of the anthropogenic global warming theory most strongly criticized by Noah Webster, who argued that Williams cherry-picked his sources. Ironically Webster sought to counter Williams's claims by himself using classical sources to find references to the range of frost-sensitive trees in the ancient world, such as olive and date trees, in support of the proposition that the climate of Italy in classical times hadn't changed appreciably. Fleming, 25-26, 46.

[25] "Climate of the U. States," *Camden Gazette*, September 12, 1816, 1.

> All seem disposed to hope that the seasons will return again as such they were in former years, but if they do not, it may be a matter of no consequence. Vegetables receive new constitutions when transplanted to an uncongenial soil or climate, so will the habitude of our bodies be doubtless changed to suit the changes of the seasons. The first effects of this natural revolution have already begun to disappear, and in a short time we shall have little to fear except from the effects of a counter-revolution, that will require our systems to relapse to their former tone.[26]

In this rosy-colored view we glimpse a common thread with the climatological patriotism of Hugh Williamson and the ostensibly impartial, but perhaps bemused, observations of Thomas Jefferson. In the minds of these thinkers climate change posed no serious danger to human civilizations, and in fact Americans, with their hardy frontier-conquering ways, might be uniquely constituted to adapt to changed climate conditions and even find opportunities in them. This climatological patriotism could have existed only in America, and only in a time when Jeffersonian ideals of political and cultural dominion over the physical environment were still the dominant ideology. In the *Camden Gazette*'s editorial, it is essentially immaterial whether the climate of the Earth is getting hotter or colder, whether it stays that way or reverts to its previous trend. Climate change is viewed as just another challenge that will ultimately be overcome by the processes of nature and, one presumes, the inherent ingenuity of man—and especially Americans.

C. How Little Things Change: 1816 and Contemporary Climate Debates

The Year Without a Summer did not end the debates about global warming versus global cooling. In the following year when summer returned more or less normally the debate largely fell off of America's newspaper editorial pages and retreated to the less

[26] Ibid.

visible arenas of scientific discourse. Ten years after the Year Without a Summer, the U.S. Army began a systematic effort to keep and publish meteorological observations for the specific purpose of documenting whether climate change was taking place and, if so, how it was manifesting itself. In the middle part of the nineteenth century scientists and observers began to rely increasingly upon empirical weather data and systematic meteorological records. Researchers such as Lorin Blodget, Elias Loomis, Charles A. Schott, William Ferrel and Cleveland Abbe further developed these methods, which by the latter decades of the century had become the basis for the modern science of climatology.[27]

By the late twentieth century the touchstone issue in climatology was the greenhouse effect—the modern problem of anthropogenic climate change caused or significantly exacerbated by effects upon the atmosphere and hydrosphere of human industrial processes, particularly emissions from the burning of hydrocarbon fuels. A history of the science and cultural context of modern anthropogenic climate change—even a short one—is beyond the scope of this paper. Nevertheless, the global warming versus global cooling debate of 1816 never quite went away. Echoes of it resurface in much more modern examples of climate discourse. Examining just a few such examples helps to illustrate how many of the climate issues surrounding the Year Without a Summer continue to resonate today.

The basis of modern analyses of anthropogenic global warming and predictions for future climate change are firmly rooted in empirical data, collected and synthesized

[27] Fleming, 45-53.

according to highly sophisticated systematic processes.[28] This data and the breadth of its coverage—everything from analyses of the width of tree rings in Arizona to ice cores taken in Antarctica—are far beyond anything available to Williamson, Jefferson and Webster, whose chief sources on climate conditions of the past consisted of references in classical literature and the fading "memor[ies] of the oldest man living."[29] Yet even today, despite the overwhelming depth of undisputed evidence that the Earth's climate is warming as a result of human activity, there is still controversy regarding these conclusions. "In fact global warming has stopped," claimed Henrik Svensmark, a Danish scientist, in a 2009 newspaper editorial, "and a cooling is beginning. No climate model has predicted a cooling of the Earth—quite the contrary."[30] A perusal of climate change denial literature, much of it published on the Internet, reveals a litany of complaints against the scientific consensus: models used to predict rising temperatures are argued to

[28] *See, e.g.*, Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis*, Susan Solomon, Dahe Qin, Martin Manning et. al., Eds. (Cambridge: Cambridge University Press, 2007).

[29] The phrase "memory of the oldest man living," or variations of it, appear with frequency in sources regarding the Year Without a Summer. For example, an article in the *Connecticut Mirror* (New Haven, CT), June 24, 1816, 2, uses a phrase like this, as does the *American Beacon* (Norfolk, VA), July 4, 1816, 3 ("The oldest person here has no recollection of a like season") and the *Concord Gazette* (Concord, NH), July 2, 1816, 2 ("The oldest inhabitants do not recollect such a season"). The recurrence of this phrase is interesting because it is indicative of how common people of 1816 conceptualized weather and climate from the past. Today we are accustomed to precise weather records; most local news weather reports, for example, include references to the historic record high temperature or record low temperature for that particular date. In 1816, before such records existed, the most common means of ascertaining weather in the past was to ask an old person. As modern climate historian James Rodger Fleming argues, however, people's memories of weather tend to be unreliable; they most often remember severe weather events, and even those recollections can be heavily influenced by what others are saying or reporting about the weather. Fleming, *Historical Approaches*, 46. Most of us, particularly when young, can recall hearing grandparents or other elders speaking of severe weather conditions in their youth, often deep snows that had to be traversed on the way to school, etc. The potential disconnect between memory and empirically measurable reality has traditionally been a large issue in the historiography of the Year Without a Summer. *See, e.g.*, Milham, "The Year 1816."

[30] Henrik Svensmark, "Svensmark: 'Global Warming Has Stopped and a Cooling is Beginning—Enjoy Global Warming While it Lasts," *Watts Up With That?*, September 10, 2009, http://wattsupwiththat.com/2009/09/10/svensmark-global-warming-stopped-and-a-cooling-is-beginning-enjoy-global-warming-while-it-lasts/ (visited April 7, 2012).

be unreliable[31]; the "hottest year on record" is erroneously asserted to have occurred in the 1930s[32]; electronic correspondence stolen from a climate research center suggests a shadowy conspiracy by scientists to forge data on climate change[33]; or even that the very idea of global warming via greenhouse gas emissions supposedly violates the Second Law of Thermodynamics.[34] In reality the consensus among scientific experts that climate change is happening, and is being caused or significantly exacerbated by human activity, is remarkable in its virtual unanimity.[35] Yet, just as the *Essex Register* pursued a campaign of denial of the facts and implications of the climate anomalies in 1816, individuals, organizations and media outlets today deny the overwhelming scientific proof of anthropogenic global warming. The reasons for modern denial of anthropogenic global warming have to do, at least in part, with the economic and political agendas of industrial cartels or adherents of particular political ideologies. Regardless of the reasons for denial, however, climate change deniers today cloak their arguments in scientific-sounding words, or seek the opinions of experts (or those who can be passed off as experts) in order to make their cases, just as deniers did in 1816. Debate about climate

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[31] Lawrence Solomon, "Fighting Climate 'Fluff,'" *Canada.com*, http://www.canada.com/nationalpost/news/story.html?id=985641c9-8594-43c2-802d-947d65555e8e (visited April 9, 2012).

[32] Michael Asher, "Blogger Finds Y2K Bug in NASA Climate Data," *Dailytech.com*, August 9, 2007, http://www.dailytech.com/Blogger+finds+Y2K+bug+in+NASA+Climate+Data/article8383.htm (visited April 9, 2012).

[33] Andrew Bolt, "Climategate: Warmist Conspiracy Exposed?", *Melbourne Herald-Sun*, November 20, 2009, http://blogs.news.com.au/heraldsun/andrewbolt/index.php/heraldsun/comments/hadley_hacked/ (visited April 9, 2012).

[34] Gerhard Gerlich & Ralf D. Tseuschner, "Falsification of the Atmospheric CO2 Greenhouse Effects Within the Frame of Physics," *International Journal of Modern Physics B* 23, no. 3 (2009): 275-364.

[35] William R.L. Anderegg, James W. Prall, Jacob Harold & Stephen H. Schneider, "Expert Credibility in Climate Change," *Proceedings of the National Academy of Sciences of the United States of America*, June 21, 2010, http://www.pnas.org/content/early/2010/06/04/1003187107.abstract (visited April 9, 2012).

change—both reasonable and unreasonable—seems to be a permanent fixture of American engagement with climate issues.

Some of the ways in which the global warming versus global cooling debate found its way into a public conversation in the summer of 1816 have been repeated in more recent times with eerie congruity. Take, for instance, a 1974 article in *Time* magazine reporting on the possibility that the Earth was headed for another ice age.[36] The article began by serving up reports of various weather and climate anomalies around the world, such as a persistent drought in Africa and a rainy winter in Britain. "Telltale signs are everywhere," the article asserted, "from the unexpected persistence and thickness of pack ice in the waters around Iceland to the southward migration of a warmth-loving creature like the armadillo from the Midwest."[37] The article cited scientific experts sparingly and in general terms, relying mostly upon more general observations of Arctic ice cover, animal migrations and patterns of icy northern winds. The anonymous author even suggested that sunspot cycles might be a factor in global cooling, though he or she conceded that there was no scientific evidence to support this supposition.[38] With the exception of stylistic differences and the specific institutional backgrounds of the few scientific experts referred to in the piece, one could envision the article appearing verbatim on an 1816 editorial page as an argument in favor of global cooling. A similar article in *Newsweek* from 1975—also predicting global cooling—utilized more statistics, but its argument was still seemed to proceed less from modern science and more from

[36] This article, and similar articles from the same era, are often cited by modern deniers of anthropogenic climate change as "evidence" that the consensus for global warming is shaky. *See, e.g.*, Dan Galnor, "Fire and Ice: Executive Summary," *MRC Business and Media Institute*, November 3, 2010, http://www.mrc.org/special-reports/fire-and-ice-executive-summary-0 (visited April 9, 2012).

[37] "Another Ice Age?", *Time*, June 24, 1974, 86.

[38] Ibid.

generalization. It relied not upon empirical data analysis, but on more general assertions such as the lengths of growing seasons, tornado outbreaks and perceptions regarding the amount of sunshine reaching the surface of the Earth.[39] Even with a great advancement in scientific thinking in the past two centuries, it seems that Americans' traditional modes of arguing about climate take a longer time to change than does global climate itself.

D. Inconvenient Truths: The Meaning of Climate Debates

Which side was "right" about climate change in 1816 is far less material than the implications of the debate itself. The evidence presented here indicates that Americans in 1816 were concerned about climate change, were divided about its causes and effects, and were unable to resolve their doubts in a way that constructed a common consensus regarding what was happening. The fact that similar debates—with many of the same features and methods of argumentation—continue today, even in the presence of *scientific* (if not *public*) consensus on anthropogenic climate change, demonstrates that there is something both deeply fascinating about climate change to the society at large, and also deeply disturbing. The weather anomalies of the Year Without a Summer presented an unusual and urgent opportunity to debate climate change, but the public relevance of that debate was by no means limited to that time or particular situation.

As argued earlier, most of the facts and assumptions Americans used to evaluate the climate anomalies came from a pastiche of knowledge that was much less heavily weighted toward expert scientific study than our similar body of collective knowledge on climate is today. In 1816 people looked toward experts to explain large natural processes

[39] Peter Gwynne, "The Cooling World," *Newsweek*, April 28, 1975, 64.

like climate, but they also looked to the stars and the zodiac, the experiences of their elders, and collections of folk knowledge and conventional wisdom. In the early twenty-first century we would be much more tempted, if we happened to witness a snowstorm in June, to consult a scientific expert as a largely definitive source for an explanation. Yet today the public conversation regarding climate change is not so different than it was in 1816. This suggests that there is something about the debate *itself* that is hard-wired into our collective consciousness.

What does seem to have changed in 200 years is our understanding of the broader implications of climate change and alterations in the global environment. Largely absent from discussions about climate in 1816 are explicit expressions of what consequences either global warming or global cooling might have on human society as a whole. Beyond the obvious impacts on short-term crops and harvests, what few expressions of consequence exist, like Hugh Williamson's or those of the anonymous author of the editorial in the *Camden Gazette*, are essentially apologia for either ignoring the impact of climate change or welcoming it: we'll either adapt, as plants often do to new environments, or the changes will make us better, stronger and more enlightened Americans. By contrast today's climate debates seldom avoid discussing consequences and implications: loss of biodiversity, rising sea levels, effects on global food production, economic shocks, and effects on population and demographics. Besides the undergirding of either pastiche of knowledge or methodological science, if there is a key difference between the 1816 climate debates and today's, this is it: an understanding of consequence.

Why? One possible answer is globalization. Today our world is interconnected like never before through a complex web of economic relationships, technology and communications, and shared interrelated historical experiences—such as the two world wars of the twentieth century—that increasingly emphasized the transnational or global dimensions of events that might once have seemed purely local. Consequently, we can conceive of environmental and climatic conditions being interrelated in the same way as many other aspects of our modern society are. But this cannot be the whole answer. People in 1816 clearly did conceive of the events of the Year Without a Summer occurring in a transnational or global context, as evidenced by frequent comparisons between climate anomalies, harvests or other conditions in the United States and Europe.[40] Although concerns were primarily local, such as with harvests or local market conditions, there clearly was awareness of the global dimensions of the climate anomalies. Nor can the answer be as simplistic as a naked assumption that Americans and Europeans were heedless of any potential negative environmental effects of human activity until deleterious effects of the Industrial Revolution began to manifest themselves concretely in the form of pollution or illnesses—a narrative that assumes, without evidence, that environmental consciousness is an invention of modernity, particularly post-World War II. Both of these approaches are reductive and miss the vast complexities and subtleties about environmental thinking in the pre-industrial age.

A richer and more complex answer may be that conception of serious negative consequences of climate change may have been difficult in the absence of a generally accepted awareness that the Earth's climate could potentially be, as a whole, subject to at

[40] *See, e.g., Boston Intelligencer* (Boston, MA), September 7, 1816, 2.

least some human control. This is not to say that people in 1816 were ignorant that human activity could affect global climate. Clearly they were not, as the debate over the effects of deforestation and cultivation demonstrates. However, totally missing from the climate debates of 1816 is any suggestion that human institutions could, as a practical matter, take action to influence the planet's climate. The commonly-understood agents of anthropogenic climate change, forest clearing and agricultural activity, were conceived at least in the United States as being part and parcel of the development of an entrepreneurial American society which, like an inexorable tide, would ultimately civilize the frontier and widen the range of economic opportunities for citizens. Economies could be influenced on their fringes by governments or social processes, but the real locus of control over an economy was in the realm of market forces themselves. Thus, if market forces and economic processes were inexorable, wouldn't their indirect effects upon climate and environment be equally impervious to meaningful control?

Today's climate debate, in a marked difference from that of 1816, presupposes that human institutions *can* make significant impacts upon the global environment. Today most governments, especially of economically advanced countries, are debating at some level appropriate policy responses to anthropogenic climate change. Whether they are ultimately judged to be good or bad from a policy perspective, most of those potential responses—emissions caps, taxation schemes, investment in cleaner energy sources, etc.—are based on the assumption that they *can* have an effect, which itself is based on a more fundamental assumption that modern civilization possesses the practical tools, in the form of state actors, economic entities, or social institutions, to alter the world's climate. We believe our existing institutions may be able to alter or mitigate the collective

human behaviors that have changed our climate. This belief does not seem to have existed in 1816.

This argument conjectures—and it can only be a conjecture—that the will to see potential harmful effects of climate change could not have emerged until there had also emerged some sense that human beings could do something about them. The problem was invisible, and possibly unthinkable, until at least the possibility of a human solution was also thinkable. If this conjecture is tenable, it may offer food for thought on the philosophical implications of our current contemporary issues of climate change. However difficult it may be to influence the collective behavior of governments, industries and millions of individuals to change their behavior in order to achieve a particular climate result, at least our modern argument conceives that this could be possible and potentially desirable.

In 1816, however, the situation was different. Although the Year Without a Summer was likely caused by volcanic catastrophe—the perhaps purest definition of a force of nature which nobody then or now could have prevented, even if they had understood what was happening—it occurred against the backdrop of a slowly-simmering argument about global climate change. A subset of that argument was the notion of anthropogenic climate change. The point to be drawn is that neither the climate change debate of the time nor public consideration of the Year Without a Summer occurred in a vacuum. They were all bound up in the same inextricable mass, weaving science, superstition, environmental awareness, opinion and belief into a richly complex tapestry. The modern debates about climate change give us a pair of glasses with which we can

begin to see some of the threads of this tapestry in a new light—and those threads may be more connected to our modern conditions than we might have thought at first.

CHAPTER VII

"THE AUTUMNAL EQUINOX IS PAST": THE AFTERMATH

A. Winter Returns…or Continues

The end of summer can be calculated precisely for each year and each locality through astronomical measurements. The moment of equinox occurs when the Earth's axis is tilted neither toward nor away from the sun, but when the center of the sun is in the same plane as the Earth's equator.[1] In Boston, the summer ended at 11:37 PM local time on the evening of Sunday, September 22, 1816.[2] At that moment the strange season passed into history. The long tail of the Year Without a Summer was just beginning.

Although summer ended with the equinox, the climate anomalies were not yet a thing of the past. Hard frosts continued to destroy late-ripening corn in many places.[3] In some places untouched by the hurricane of early September, drought conditions, which had characterized most of the summer, persisted. "The Autumnal equinox has passed," wrote one correspondent on the very day the summer ended, "but we have had neither wind nor rain. The oldest inhabitants say, that such a drowth [drought] has never been apprehended here since their remembrance."[4] It is impossible to tell when the climate anomalies related to the Mt. Tambora ejecta ended and the "normal" cycle of the seasons resumed; the very idea of such a delineation is largely meaningless. Many Americans

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[1] The equinox is not, as many lay people assume, simply the day on which the length of daylight and night is equal. In fact, on the day of an equinox, the day is usually a little longer than the night.

[2] "Seasons Calculator—Boston, Massachusetts, USA—Years 1800-1849," *TimeAndDate.com*, http://www.timeanddate.com/calendar/seasons.html?year=1800&n=43 (visited April 13, 2012).

[3] Goffe, Diary, September 1816; *Columbian Register* (New Haven, CT), October 12, 1816, 2.

[4] *Richmond Enquirer* (Richmond, VA), October 19, 1816, 2.

must have felt weary at the prospect that, in late September 1816, they faced another six months of wintry weather before the next chance of a reprieve presented itself.

One of the ways in which the summer had been unusual was the erratic nature of the weather. Far from being, as some might expect from the moniker "the Year Without a Summer," an unbroken spell of cold and wintry weather, there were temperate, summer-like days in virtually all places, and even spells of extreme heat.[5] The erratic temperature swings and sudden changes in weather were part of why the summer appeared so noteworthy. One indication that the climate was still suffering from Tambora's effects is that the erratic nature of the weather continued into the winter of 1816-17. A strange warm spell, for instance, occurred in Massachusetts toward the end of December. Isaiah Thomas of Worcester recorded in his diary that on Christmas Eve day it was 60 degrees Fahrenheit indoors, in a room without a fire, and 64 degrees outside.[6] Whether it was comfortable to lay a fire indoors was a key measure of weather.[7] Only a few months earlier, at the end of August, Thomas had written by contrast that there was "no month but what in several days of it a fire has not been very agreeable."[8]

In addition to an *erratic* winter, if the climate effects of Tambora were still pinching even after the summer was over, one would expect to see indications of a *severe* winter. There are such indications. Three weeks after the December warm spell, a severe

[5] *Camden Gazette* (Camden, SC), September 12, 1816, 1.

[6] Thomas, Diary, December 24, 1816.

[7] The evaluation of cold in terms of whether fires were needed or comfortable indoors appears frequently in accounts of the Year Without a Summer. John Quincy Adams speaks of it in his diary entries. Adams, *Memoirs*, July 19, 1816, III:404. It also appears in newspaper accounts as a common yardstick of coldness. *See, e.g., Concord Gazette* (Concord, NH), July 2, 1816, 2; *Columbian Register* (New Haven, CT), August 17, 1816, 2.

[8] Thomas, Diary, August 1816.

cold snap froze New England solid. On the next page after he noted the balmy weather of Christmas Eve, Isaiah Thomas recorded the following, in tiny, virtually microscopic handwriting that gives the reader an irresistible mental image of a man huddled in a chair, his hands numb with cold and the ink growing thick and gelatinous:

> [January] 14. Fair. Very cold. Wind N. Thermometer in the small South room morning ½ past 7 o'clock this morning 14 above 0. Out doors stood at 0. Wind at NW grew exceedingly boisterous. Coldest night this season, and for 20 years past.[9]

The winter and spring of 1816-17 was a hard one across much of the world. Effects of weather-related crop failures reverberated throughout 1817, especially in Europe. Although the climate anomalies were not its only cause, clearly they were a major contributor to the famine that some historians have characterized as the most severe situation of food scarcity in Europe since the seventeenth century. During 1817, wholesale prices of grain hit a five-year peak in every country in Europe, except Austria, as well as in the United States.[10] Not only the quantity and price of grain was affected, but also its quality. Flour ground from wheat produced in the stunted harvest of 1816 was thin and insubstantial. A French peasant noted in 1817, "You could not eat the bread. It stuck to the knife."[11] The famine that struck Ireland beginning that winter reduced people to eating moss and cats. An equally severe famine struck Switzerland, where the city of Zürich was overwhelmed by hordes of hungry peasants. In January 1817, a riot broke out in Fauville, France, when an unusually scanty grain shipment sparked townspeople to

[9] Ibid., January 14, 1817.

[10] Post, 27-37. Austria's wholesale grain prices peaked in 1816. It is noteworthy that the data for the United States includes the period of the economic downturn occasioned by the Panic of 1819. Yet grain prices were almost double in 1817 what they were in 1819, and even greater than that in 1820.

[11] Ibid., 41 (quoting Louis Guéneau, "La disette de 1816-1817 dans une region productrice de blé, la Brie," *Revlue d'histoire moderne* 9 (January-February 1929): 21-22).

stone a cadre of soldiers and sack the town hall. Similar riots played out all throughout the French countryside.[12] The level of violence in France as a whole in 1816-17 was the highest it had been since the era of the Revolution.[13]

B. Would It Happen Again?

Looking back from the vantage point of history, the climate anomalies of 1816 seem discrete and partitioned in time. The popular name given to the events—the "Year Without a Summer"—imposes historical myopia by stressing the singular dimension. In truth the climate had begun to react to Tambora in 1815, shortly after the eruption, and it does not seem to have returned to (more or less) "normal" until some indeterminate time in 1817. Indeed at the time there was no way of knowing how long the phenomena would last or whether cold summers and bizarre weather anomalies were destined to become the permanent state of things. The attention given to the scenario of global cooling indicates that some Americans were preparing themselves for the possibility that the climate might never return to normal. In May and June of 1817 in New England, however, there are suggestions that people feared the Year Without a Summer was about to happen all over again.

May 1817 seems to have been an abnormally cold month. William Paine, the Worcester, Massachusetts, doctor who almost always opened his diary entries with a description of the wind and weather, noted cold conditions many times during this month, usually describing it as "very cold for the season." Frost—the perennial crop-killer of the previous year—persisted late into the month. On May 23 Paine wrote, "Mr. Lowle

[12] Stommel, *Volcano Weather*, 47-50.

[13] Post, 69.

replanting onions which have been destroyed by frosts. I never knew such desperation in our fields, and gardens, as I have witnessed this season."[14] The cycle of cold weather, unexpected frosts and ruined crops must have seemed wearily familiar.

At the very end of May, a weather shock occurred. On Tuesday, May 27, 1817, a cold front moved in and deposited a considerable quantity of snow in central Massachusetts.[15] The snowstorm must have affected many parts of the northeast, for there were also reports the same day of snow in Albany, New York.[16] Isaiah Thomas recorded in his diary that snow fell on the evening of May 27 on Mt. Wachusett, located in Worcester County.[17] The storm occurred only ten days earlier in the year than had the snow event of June 1816 which struck many people as unusual or alarming. In an article reporting the May snowstorm, a New York paper exclaimed, "When will the age of wonders pass away?"[18]

The New England snowstorm of May 1817 clearly gave rise to fears that the climate anomalies were going to repeat themselves for a second consecutive summer. Shortly after the snow a New Hampshire farmer penned a letter to a Boston paper expressing these fears:

> The weather has been as remarkable this season as the last in some instances. On Tuesday, the 27th of May, we had a rain from the south-west, and what is remarkable, it began to snow…so that the tops of our highest hills were white at 12 o'clock, noon. On Sunday morning, the 1st of June, I carried ice into the house at 9 o'clock A.M. as thick as common window

[14] Paine, Diary, May 14, 1817.

[15] *Boston Daily Advertiser* (Boston, MA), June 4, 1817, 2.

[16] Ibid., June 6, 1817, 2.

[17] Thomas, Diary, May 27, 1817.

[18] *Albany Gazette* (Albany, NY), June 2, 1817, 3.

> glass. Corn in some places is frozen to the ground. The prospect for a crop of corn and grass is as gloomy as the last season.[19]

The weather continued cold through the beginning of June. On June 12, Isaiah Thomas noted that fires indoors—again, that traditional indicator—had been "agreeable" for the past three days.[20]

Eventually the climate began to return to normal. After June 1817, there are no more widespread reports of significant anomalous cold weather, although depressed global temperatures in general persisted until 1819.[21] Based on scientific models for volcanic eruption events, the gradual dissipation and fallout of the Tambora particulates probably took about six years.[22] By 1821, five years after the Year Without a Summer, the agency that science was later to blame for causing the anomalies was no longer active. But other traces of the Tambora catastrophe—physical, intellectual, and historical—remained.

C. The Emergence of Scientific Understanding

In the years following 1816, scientific understanding of the causes and effects of the climate anomalies slowly began to emerge. One of the most significant effects of the disaster was disease. An epidemic of typhus struck many countries of Europe between 1816 and 1819, and was most likely caused by a convergence of factors—the climate anomalies, resulting famine, and economic hardship—in which the role of the weather

[19] *Boston Daily Advertiser*, June 7, 1817, 2.

[20] Thomas, Diary, June 12, 1817.

[21] Cole-Dai, Ferri, Lanciki, et. al., 1.

[22] Rampino, 79.

disturbances was key.[23] Understanding of the link between climate conditions and typhus existed even before the Year Without a Summer was over. The lengthy *Camden Gazette* editorial which attempted to throw a rope around the entire phenomena mentions that, as a result of the climate anomalies, typhus, "a disease hardly known in former years, has now become common amongst us." The article claimed that typhus began in New England "in the course of a long period of unusually cold damp weather" and then spread outward to most parts of the United States.[24] Three years later a scientific newspaper ran a long article on the subject of typhus, specifically linking its outbreak and increased occurrence to especially wet, cold seasons.[25] Today typhus is not regarded as being linked to weather or climate, but is thought of as a disease common in situations of overcrowding and poor conditions—prisoner-of-war camps and ghettoes of World War II being two famous examples. It is not clear why nineteenth century doctors assumed a link between climate and typhus.

Typhus was not the only disease that some have tried to link to climate conditions. Modern scholars have asserted the Year Without a Summer as a causal factor in the great cholera epidemic which peaked in 1832, but which may have begun in India as early as 1816. There is no indication that contemporaries understood cholera in this way, however.[26]

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[23] Post, 127.

[24] "Climate of the U. States," *Camden Gazette* (Camden, SC), September 12, 1816, 1.

[25] *American Watchman* (Wilmington, DE), July 10, 1819, 2.

[26] The hypothesis of the climate anomalies causing the worldwide cholera epidemic which took 16 years to circle the globe was the chief argument in Henry and Elizabeth Stommel's article in *Scientific American* on the Year Without a Summer. Henry and Eliabeth Stommel, "The Year Without a Summer," *Scientific American* 240, No. 6 (1979): 176-86. This article was later expanded into a book four years later, but the cholera hypothesis appears as only one short chapter. In that chapter the Stommels admitted that

The Tambora eruption was slow to be connected to the climate anomalies. Although the mountain's catastrophic eruption had made contemporary papers—ironically, news of it reached the U.S. eastern seaboard only a few months before the anomalies struck in earnest in the late spring of 1816[27]—its true effects and importance were not immediately apparent. Within ten years, scientific observers had begun to understand how colossal and exceptional the eruption had been. An 1825 article, for instance, correctly characterizes the Tambora eruption as having resulted in unusual amounts of dust, ash and particulates flying into the atmosphere.[28] But it was not until the early twentieth century that this understanding, placed into the context of the newly-emerged scientific field of climatology, crystallized into a cogent theory of causation.

On New Year's Day, 1913, W.J. Humphreys, professor of "meteorological physics" at George Washington University, presented a paper in Cleveland, Ohio, before the Astronomical Society of America. His paper argued that global climate changes—observable from physical traces found in lake beaches, glacial moraines and other geological sources—were caused by dust injected into the atmosphere by significant volcanic eruptions. His paper eventually became an article published in the *Journal of the Franklin Institute* which compared various historic eruptions and attempted to quantify the climatic effects of volcanic dust with empirical and mathematical evidence. In addition to Tambora, he noted the 1783 eruption of Mt. Asama in Japan and various other eruptions such as Peleé (Martinique, 1902) as especially significant agents of climate

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the hypothesis was farfetched, noting that "the rate of spread seems to have been extraordinarily slow." Stommel, *Volcano Weather*, 111.

[27] *Evening Post* (New York, NY), February 27, 1816, 2.

[28] *National Gazette* (Philadelphia, PA), July 9, 1825, 4.

change.[29] Humphreys did not claim to be the first to assert a theory of this nature, though he may have been the first to do so in English. He cited the work of two Swiss scientists, the Sarasin brothers, as a strong influence; their theory, published in 1901, was evidently that ice ages were "caused by the absorption of solar radiation by high volcanic dust-clouds."[30] Presaging modern climate change research, Humphreys compiled tables of temperature data from 1880 to 1912 and correlated statistical departures from average temperatures against the record of volcanic eruptions from the same period. The valleys of his temperature graphs corresponded with the aftermath of major eruption events.[31]

A likely reason for the timing of the emergence of this theory was the presence, in the recent past, of another major volcanic eruption that could serve as a basis of comparison. On August 26, 1883, Krakatoa—also located in Indonesia—erupted so violently that the shock wave annihilated much of the island on which the mountain was located and generated 100-foot tsunamis that killed at least 36,000 people.[32] This was the first major eruption capable of causing noticeable climate change that occurred after the advent of telegraphy and instant global communication. Krakatoa catalyzed a sea change in understanding the link between volcanism and climate change not just because people

[29] W.J. Humphreys, "Volcanic Dust and Other Factors in the Production of Climatic Changes, and Their Possible Relation to Ice Ages," *Journal of the Franklin Institute* CLXXVI, no. 2 (August 1913): 131-172.

[30] Ibid., 137 (citing P. & F. Sarasin, *Verhandlungen der Naturforschenden Gesellschaft in Basel*, Vol. 13 (1901)).

[31] Ibid., 154.

[32] Ian Thornton, *Krakatau: The Destruction and Reassembly of an Island Ecosystem* (Cambridge, MA: Harvard University Press, 1996), 1-3. The official name of the volcano, and the island associated with it, is "Krakatau." At the time its eruption was reported, however, it became known as "Krakatoa," possibly as a result of a transcription error by a single editor of the London *Times*. This is the name and spelling that has stuck in popular consciousness, not least of all due to the 1969 film *Krakatoa, East of Java*, which portrayed the events of the eruption with appalling inaccuracy. (Krakatoa is actually *west* of Java). Because of its recognition in popular culture, for purposes of this paper I use the term "Krakatoa."

all over the world—at least those who read newspapers—knew about the eruption shortly after it happened, but because its evidence was visible in the skies, especially at sunset. Volcanic particulates from Krakatoa are credited with causing particularly brilliant sunsets that inspired late nineteenth century painters including Edgar Degas and Jasper Francis Crospey.[33] There is some evidence that Krakatoa had a slight cooling effect on the climate. Humphreys's data on temperature deviations from normal shows the single largest negative deviation—1.6 degrees below the statistical average, compiled from seventeen American weather stations—in 1884, the year after the eruption.[34] The Krakatoa eruption was of a far lesser magnitude than the 1815 Tambora blast, although many people did not understand this at the time.[35]

Humphreys's theory was accepted, and within a decade or so it had become the generally accepted explanation for the cause of the Year Without a Summer. In December 1924, Williams College astronomer Willis I. Milham authored an article on the climate anomalies of 1816 in which he cited Humphreys and characterized his analysis as the leading causation theory. Milham summarized various battles among meteorologists as to

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[33] C.S. Zerefos, V.T. Georgiannis, D. Balis, S.C. Zerefos, and A. Kazdntzidis, "Atmospheric Effects of Volcanic Eruptions as Seen by Famous Artists Depicted in Their Paintings," *Atmospheric Chemistry and Physics* 7 (2007): 4027-4042. Even Edvard Munch's famous picture "The Scream," painted ten years after the Krakatoa eruption, is said to have been influenced by the famous sunsets, which supposedly appear in the painting as the red skies behind the figure. Russell L. Doescher, Donald W. Olson and Marilynn S. Olson, "When the Sky Ran Red: The Story Behind 'The Scream,'" *Sky & Telescope* 107, no. 2 (February 2004): 28. The link between volcanic eruptions and spectacular sunsets is now well-known by many people today. I recall associating particularly stunning sunsets in the late summer and early fall of 1991 with the recent eruption of Mt. Pinatubo in the Philippines, long before developing any academic interest or consuming any scholarly material on the subject.

[34] Humphreys, "Volcanic Dust," 154.

[35] Humphreys erroneously asserted that the Krakatoa eruption was larger than Tambora. He was under the impression—not shared by modern scholarship—that the largest eruption in recorded history was the 1783 eruption of Japan's Mt. Asama. Likely he was conflating two separate eruptions. Laki, a volcano in Iceland, also erupted in 1783. This is the volcano that seems to have caused the "dry fog" that Benjamin Franklin wrote of while he was residing in France. Rampino, 74. Humphreys cited Franklin's observations in the context of the Asama eruption.

whether 1816 was in fact as "abnormal" as popular culture had it, and proceeded to argue that it was not. He claimed that other years of the early nineteenth century, especially 1837, were statistically as cold as 1816, based on extant weather data, but the prevalence of cold snaps all bunched together in the summer months gave the impression that the year's climate was extraordinary.[36] Yet Milham's analysis was fundamentally flawed. He ignored and continually minimized well-documented reports of weather anomalies, particularly snowfalls, in an attempt to reduce the phenomenon to "three cold spells" that were not qualitatively different, in his view, than cold snaps in a normal year.[37] In discussing sunspots—again, the traditional obsession—Milham also replicated the same error made by observers both before and after him, by asserting that sunspot activity was at a high in 1816 rather than a low.[38]

Milham's 1924 article set the pattern that was followed by most academic scholars regarding the Year Without a Summer until the end of the twentieth century: general acceptance of the Tambora causation theory, but argument over how severe the effects were and what their scientific implications might have been. Articles taking this approach continued to appear sporadically, almost always written by scientists.[39] Historians were largely uninterested. Given that virtually all of the published literature on the Year

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[36] Milham, 563-70.

[37] Ibid., 564.

[38] Ibid., 566. Milham can possibly be forgiven this error, due to the fact that he relied on indices compiled from reports of *visible* sunspots. As we know, the volcanic dust from Tambora suspended in the atmosphere rendered sunspots more visible in 1816 than they otherwise would have been, despite the fact that they were then toward the down-slope of an 11-year cycle, and also in a larger down cycle called the Dalton Minimum. Although Milham, writing in the early 1920s before satellite and infrared observation of sunspots was possible, can be forgiven for this error, subsequent historians' duplication of it cannot be as easily countenanced. Skeen, for instance, cites Milham's article as a chief scientific source, and possibly as a result Skeen asserts that sunspots were at a maximum in 1816. Skeen, 10.

[39] *See, e.g.,* Patrick Hughes, "1816 The Year Without a Summer," *Weatherwise* 32, no. 3 (1979): 108-11.

Without a Summer has been written by people with scientific backgrounds—usually meteorology, climatology or volcanology—the perception seems to have jelled that the subject belonged to scientists alone.

The scientific thought behind the Year Without a Summer did not change significantly until the twenty-first century, but beginning in the 1980s the subject began to take on new relevance as issues of climate change grew in public importance. Popular interest in the 1816 anomalies seems to have increased in the early 1980s, with a book on the subject emerging in 1983[40] and other articles coming out after that.[41] One possible reason for this increase in relevance was the development of the "nuclear winter" theory, which warned that catastrophic global cooling could result from smoke particles pumped into the atmosphere from burning cities in the aftermath of a large-scale nuclear war. "Nuclear winter" was first given serious study in a 1982 paper published by the Royal Swedish Academy of Sciences[42] but propelled into public light by the advocacy of popular astronomer Carl Sagan, whom the public identified as the face of scientific opposition to nuclear weapons.[43] Coming as it did at the tense climax of the late Cold War period, when public interest in nuclear issues was at an all-time high, the nightmare scenario of nuclear winter resonated powerfully. Due to its similarity to volcanic-agency

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[40] Stommel, *Volcano Weather*.

[41] *See, e.g.,* Stephen Eric Levine, "Year Without a Summer in New England?", *Weatherwise* 40, no. 1 (February 1987): 5; Stephen Self, "The Year Without a Summer? World Climate in 1816," *Journal of Volcanology and Geothermal Research* 56, no. 1-2 (May 1993): 173-74.

[42] Crutzen and Birks, 114-25.

[43] Sagan co-authored a 1983 article on nuclear winter (R.P. Turco, O.B. Toon, T.P. Ackerman, J.B. Pollack and Carl Sagan, "Nuclear Winter: Global Consequences of Multiple Nuclear Explosions," *Science* 222, no. 4360 (December 23, 1983): 1283-1292), but even before this he had been powerfully associated with scientific opposition to nuclear weapons by way of his popular television series *Cosmos* which first aired in 1980. At the end of his life—he died in 1996—Sagan was also associated with scientific activism to combat anthropogenic global warming.

climate changes, references to the Year Without a Summer appeared frequently in nuclear winter literature.[44] Indeed, nuclear winter represents a sort of apocalyptic man-made facsimile of the Year Without a Summer: instead of being caused by a volcano—an agency that no human being can control—it is brought about by man's own action, and instead of dead crops and a freezing summer, the likely result is the total extinction of humanity.

D. Modern Scholarship: The Toba Catastrophe and "Mountain X"

It was modern research into anthropogenic global warming that opened the next chapter in the scientific historiography of the Year Without a Summer. With the dawning of widespread public awareness of anthropogenic climate change around 1990, climatology research of all kinds began to assume critical importance. The search for answers to modern problems of global warming illuminated previously undiscovered events of the past, directly relevant to the Year Without a Summer.

In 1988, a major paper appeared in the *Annual Review of Earth Planetary Science* discussing the phenomena of volcanic winters. Using data from ice cores taken in Greenland and Antarctica as well as modern computer modeling then being employed to study global warming, the authors of the article—Rampino, Self and Stothers—explained the exact chemical processes behind volcanic climate change with a precision that Humphreys could only have dreamed of.[45] The article also analogized volcanic winter to

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[44] *See, e.g.*, Barbara G. Levi and Tony Rothman, "Nuclear Winter: A Matter of Degrees," in *Physics and Nuclear Arms Today*, ed. David W. Hafemeister (New York: American Institute of Physics, 1991), 19-26.

[45] Rampino, 73-99. The Rampino article contains probably the most precise scientific work that had been done up to that time on the Year Without a Summer, calculating the size of the ash cloud and the length

nuclear winter. Toward the end of the article, the authors referred to a "supereruption" of a volcano called Toba, also in Indonesia, which occurred about 75,000 years ago. Referring to the evidence of this eruption found in ice cores, the article noted that "[t]he Toba ash layer is extraordinarily widespread." The authors calculated that the amount of material ejected from Toba was a staggering 20,000 megatons—one hundred times the amount of stratospheric aerosols generated by Tambora in 1815. "The atmospheric after-effects of a Toba-sized explosive eruption," Rampino and his colleagues noted tersely, "might be comparable to some scenarios of nuclear winter, although the aerosols are expected to have a longer residence time than would the nuclear winter smoke."[46]

Five years later another study appeared elaborating upon the ominous ring of the Rampino article. This article, authored by Ann Gibbons, postulated that the catastrophic Toba eruption was responsible for a "human population bottleneck"—in other words, a mass die-off of the human species that had profound implications for the evolutionary development of the modern human race.[47] Rampino and Self, who wrote the 1988 article, eagerly supported Gibbons's analysis.[48] Although the "Toba Catastrophe Theory" is not without controversy, having been debated hotly in scientific literature, popular science outlets and the Internet,[49] it has significant cachet among well-respected scientists.[50] If

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of time it lingered in the atmosphere. Ibid., 83-85. Stephen Self, one of the co-authors of this article, had previously written on the Year Without a Summer for *Weatherwise* magazine.

[46] Ibid., 90.

[47] Ann Gibbons, "Pleistocene Population Explosions," *Science* 262, no. 5130 (October 1, 1993): 27-28.

[48] Michael R. Rampino and Stephen Self, "Bottleneck in Human Evolution and the Toba Eruption," *Science* 262, no. 5142 (December 24, 1993): 1955.

[49] *See, e.g.*, "Mount Toba Eruption—Ancient Humans Unscathed, Study Claims," *Anthropology.net*, July 6, 2007, http://anthropology.net/2007/07/06/mount-toba-eruption-ancient-humans-unscathed-study-claims/ (accessed April 20, 2012).

true, the Toba Catastrophe Theory represents an example of the Year Without a Summer writ nightmarishly large: a volcanic eruption so huge and catastrophic that the resulting climate change nearly annihilated the entire human species. Should such an event occur again, and be even slightly more severe than the Toba eruption, it could cause the end of human civilization.[51] Seen in this context, the Year Without a Summer represents a small sip from a bottle containing an elixir of ultimate annihilation.

Climate change research involving ice cores also altered the narrative of causation of the Year Without a Summer itself. In the early twenty-first century, scientists began to notice that ice cores taken at opposite poles of the Earth, in Greenland and Antarctica, contained not only traces of the Tambora fallout dated to the 1815 eruption, but *another* layer of fallout just beneath it—from a totally unknown source. A 2009 article explained:

> [A]n initial study found high concentrations of sulfuric acid in the 1810-1811 snow layers in a few ice cores from Greenland and Antarctica and suggested that a stratospheric eruption occurred around the year of 1809, six years before the Tambora eruption. The volcanic fallout in both polar regions indicated the volcano was in the tropics, for only large eruptions in the tropics can deposit volcanic sulfuric acid in both polar regions.[52]

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[50] *See, e.g.*, Stanley H. Ambrose, "Late Pleistocene Human Population Bottlenecks, Volcanic Winter and Differentiation of Modern Humans," *Journal of Human Evolution* 34 (1998): 623-51.

[51] If inclusion on Wikipedia is any sort of bellwether as to popular zeitgeist, volcanic winter has a secure place in a list of end-of-the-world scenarios. Wikipedia's article on "Risks to Civilizations, Humans and Planet Earth" mentions volcanic winter alongside potential planet-killers such as global nuclear war, alien invasion or the impact of an asteroid similar to the one believed to have killed the dinosaurs (the "K-T Event"). This article mentions both the Toba Catastrophe Theory and the Year Without a Summer as examples of this potentiality, and concludes ominously that it is probably more likely than other scenarios listed on the page: "Supervolcanoes are more likely threats than many others, as a prehistoric Indonesian supervolcano eruption may have reduced the human population to only a few thousand individuals, while no catastrophic bolide [asteroid] impact, for example, has occurred since long before modern humans evolved." "Risks to Civilizations, Humans and Planet Earth," *Wikipedia*, http://en.wikipedia.org/wiki/Risks_to_civilization,_humans_and_planet_Earth (accessed April 20, 2012).

[52] Cole-Dai et. al., 2.

Given the position of the evidence in the ice cores and the amount of time it likely took for the fallout to reach the poles, the article hypothesized that the mysterious eruption most likely occurred in February 1809. The evidence in the ice cores indicated that the eruption was significant enough to alter the Earth's climate at least slightly—thus accounting for unusually cold temperatures beginning in 1810.[53] Seen from this perspective, then, the Year Without a Summer is more of a progression than a specific event disparate in time. The eruption of "Mountain X" in February 1809 nudged the Earth's climate toward a colder average, but not enough to manifest itself in noticeable climate anomalies; the subsequent eruption of Tambora, however, pushed the already-stressed climate even further, thus resulting in the Year Without a Summer. This potential narrative could explain why some contemporaries in 1816, especially those arguing in favor of a global cooling trend, perceived that the climate had already been trending colder even prior to that year.[54]

The extant historical record contains no mention of a very large eruption in February 1809.[55] However, the ice core data indicates positively that it must have happened. Which volcano, then, is "Mountain X," and where is it located? In a table listing historic volcanic eruptions that coincided with sunspot anomalies, Humphreys listed a potential eruption of Mt. Etna in 1809 that was evidently unconfirmed.[56] At first

[53] Ibid., 1-5.

[54] "On the Cold of the Present Season," *Lynchburg Press* (Lynchburg, VA), September 26, 1816, 2.

[55] Cole-Dai et. al.,1. The scientists evidently searched for such evidence in eyewitness accounts of volcanic eruptions, atmospheric observations and what limited volcanological data exists from the early nineteenth century. Cole-Dai, the chief author of this article, confirmed that the identity of "Mountain X" remains unknown, but that it is not of much interest to climatologists; it is up to historians to resolve this question. Jihong Cole-Dai, email message to author, November 12, 2011.

[56] Humphreys, "Volcanic Dust," 162. The entry reads, "Etna (?), Sicily, 1809. (Uncertain)."

blush it seems unlikely that "Mountain X" is Mt. Etna. A volcano located in a European country erupting with enough force and ejecta to change the climate of the globe would not have gone unnoticed, and in any event Sicily may not be located in appropriate latitudes for its particulates to be spread to both poles. There are many powerful volcanoes, however, in tropical locations like Indonesia or the Philippines—areas thinly-colonized by European powers in 1809—that possess the necessary volatility to fit the profile of "Mountain X." It is easy to imagine a scenario in which a catastrophic eruption occurred and was recorded in native records, oral histories or other sources that would have gone unnoticed to European colonizers and thus might well appear invisible to Western scholarship even today.[57] If this is the case, the identification of "Mountain X" in a formerly unrecognized source lurks as a tantalizing potential discovery for future historians studying the Year Without a Summer.

E. The Long Tail: A Strange Summer Remembered

Eighteen-sixteen is one of the most-remembered summers in history. It is famed as the backdrop against which Mary Shelley's *Frankenstein*—arguably the most famous horror novel in the English language with the possible exception of Bram Stoker's *Dracula*—was conceived. Its amazing tales of snowstorms in June, frost in August and hardscrabble survival in the face of adversity are rich fodder for folklore. Its obvious relationship to troubling modern issues of climate change, as well as its similarity (in kind if not in scale) to a potential doomsday scenario that could mean the end of all

[57] Indeed, all of the principal sources we have today regarding the 1815 Tambora eruption are European. If a historian has made an attempt to examine or assess the Tambora catastrophe from the viewpoint of native inhabitants of Sumbawa, this author is unaware of it.

human life on Earth, continually replenishes its relevance. The long tail of the summer that began with the autumnal equinox has not run out yet, even almost two centuries later.

The Year Without a Summer has remarkable saturation in modern popular culture. It is classic *Reader's Digest* material, and indeed has been profiled in that popular publication.[58] Blogs and articles on the Internet continually re-hash its anomalies, its wonders and its implications.[59] The old tropes that surround the story—*Frankenstein*, Tambora, the June blizzard, speculation about sunspots, etc.—tag along with it in faithful tandem. The phrases "Year Without a Summer" or "Eighteen Hundred and Froze to Death" have a level of name recognition among members of the general public that is remarkable for a historical event that occurred 200 years ago and did not involve war, political events or famous personalities.[60] Public interest in the phenomenon is likely to increase and peak as its bicentennial approaches, but it will probably always remain popular as a historical anecdote.

The aftermath of the Year Without a Summer presents almost as many interesting angles as does examination of contemporary reaction itself. Anxiety plays an almost commanding role in this aftermath: the initial anxiety in 1817 that the anomalous summer

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[58] Fairfax Downey, "The Year Without a Summer," *Reader's Digest* (August 1940).

[59] *See, e.g.*, "The Year Without a Summer in Jane Austen's Life," *Jane Austen's World*, October 2, 2007, http://janeaustensworld.wordpress.com/2007/10/02/the-year-without-a-summer-in-jane-austens-life/ (accessed February 27, 2011); Jaime McLeod, "The Year Without a Summer," *Farmer's Almanac Blog*, March 22, 2010, http://www.farmersalmanac.com/weather/2010/03/22/the-year-without-a-summer/ (accessed February 28, 2011). A Google search for the phrase "Eighteen Hundred and Froze to Death" results in over 7,000 hits, most of them short articles of a general nature, almost all of them including one or all of the tropes mentioned here. There is even a "fan" page on Facebook for "Eighteen Hundred and Froze to Death." http://www.facebook.com/pages/Eighteen-hundred-and-froze-to-death/143764325637118 (accessed February 28, 2011).

[60] Name recognition does not equate to correct identification or understanding, however. Based on the author's admittedly imprecise and informal polling of random members of the public, overwhelmingly the most common reaction to the words "Year Without a Summer" is something to the effect of, "I know I've heard of that but I don't know anything about it."

would repeat itself, anxiety about disease vectors and climate change, and even existential anxieties about potential doomsday scenarios of which the 1816 anomalies might have been a small taste. Clearly something about the Year Without a Summer plays on our fears at the same time as it fascinates us. The almost total absence of historians from conversations about the Year Without a Summer is puzzling. Nevertheless, this brief overview of the long tail of the summer of 1816 should underscore in no uncertain terms the main argument of this paper: that, for all the different ways in which people reacted to this event, it mattered in very profound ways. If it did not, the tail of that summer would not have been quite so long; in truth we have not yet seen the end of it.

CHAPTER VIII

CONCLUSION: “THE MIGHTY OPERATIONS OF NATURE”

A. What Does It Mean?

The main argument of this paper is that the myriad of reactions to the Year Without a Summer—scientific, religious, political, spiritual, and artistic—demonstrate that, far from being an isolated incident or a curious anomaly, the climate disaster of 1816 carried implications that stretched deep into American society. At its core the Year Without a Summer shows Americans’ apprehensions about their relationship to their physical environment, their incomplete trust of science or other sources of foundational knowledge, and their appreciation that they existed and lived their lives in a precarious position that could be upset or undermined at any time by environmental factors incapable of easy explanation. Furthermore, the continued scientific and popular attention given to the event in the two centuries since its occurrence shows the way in which the issues it raised—especially climate change—are closely related to contemporary problems and debates. If we wish to understand the totality of climate change and our potential reactions to it, we ignore the Year Without a Summer at our peril.

Exploring societal reactions to the Year Without a Summer also provides us a chance to understand the history and development of environmental awareness, especially as it relates to climatology. Many of the examples presented here—especially the public debate about global warming versus global cooling—challenge traditional notions that societal awareness of global environment, and appreciation of mankind’s capability to affect it, are fairly recent developments. Today we take for granted that

ecosystems and environmental actions are connected. We are not surprised by the idea that pesticides sprayed on grapes in Chile might sicken schoolchildren in California, or that carbon emissions from Chinese auto factories might affect the severity of hurricanes in the Gulf of Mexico. The reductive view of environmental awareness often begins post-World War II, or even with Rachel Carson's *Silent Spring*. This view does not easily admit the fact that people in the early nineteenth century understood that human activity like clearing forests and cultivating lands could have a cumulative measurable effect upon the environment of the planet. We did not discover the possibility of anthropogenic climate change in the era of the internal combustion engine; understanding of that possibility existed long before. Correctly understanding humanity's past relationship with global climate and global environment seems intuitively to be a prerequisite to solving current climate-related problems. Evaluating reactions to the Year Without a Summer can contribute to this understanding.

Furthermore, appreciation of Americans' relationship to science and knowledge of the natural world in 1816 can also be instructive as our modern society continues to grapple with issues related to science in education, faith and public policy. When they were snowed on in June or watched their crops die from frosts in the dog days of August, Americans drew upon their collective pastiche of knowledge for answers—not just science, but also superstition, religion and conventional wisdom, sometimes sage and sometimes ridiculous. There are cautionary lessons here. Perhaps Americans in 1816, lacking solar probes, a Hubble telescope or even a well-developed institutional discipline of climatology, can be forgiven for thinking so often that sunspots could be affecting the weather. It is much harder to understand why, in our modern era, erroneous ideas about

sunspots affecting climate persist, even when our modern tools of scientific investigation have failed to uncover any reliable evidence of a link between them. Similarly, basing a judgment that global climate was getting cooler upon anecdotal testimony from German brewers and Swiss vintners, or a naked supposition that a legendary earthquake somehow caused it all, might have been defensible in 1816, when most of what passed for scientific observation was anecdotal and non-systematized. Less defensible, in our age of scientific achievement and intense methodological study of climate, is a broad dismissal of the reality of anthropogenic global warming because "it's cold today in Wagga Wagga."[1] But the similarity in reasoning (or lack thereof) in these examples, separated in time by two centuries and a vast difference in the level of scientific understanding available, shows us that we must still be careful when reaching conclusions about how the environment and the natural world really work.

B. The Year Without a Summer as a Challenge to the American Project

An overarching theme in reactions to the 1816 climate anomalies was apprehension, anxiety or fear. People feared that their crops would fail and they would be left destitute. People feared that the weather might never return to normal and they would have to adapt permanently to an unfavorably altered climate. A small minority literally feared the end of the world. Americans might have had particular reason to be apprehensive, as the Year Without a Summer potentially challenged their emerging national identity.

[1] Coby Beck, "It's Cold Today in Wagga Wagga: Weather and Climate are Different," *Grist*, http://grist.org/climate-energy/its-cold-today-in-wagga-wagga/ (accessed April 21, 2012).

In 1816 the American project was still new. Only forty years distant from the American Revolution, the new nation had only a year before emerged from their second war with Great Britain, a contest interpreted by many as a vindication or completion of the Revolution of 1776.[2] Although Thomas Jefferson in 1816 was happily retired to Monticello, the Democratic-Republican project that he had founded in 1800—a nation looking to western frontiers, hoping to build an "Empire of Liberty"—was still the dominant socioeconomic ideology, perhaps more so in 1816 than ever before as the Federalists faded into powerlessness. Conquest of a frontier and the reduction of it to a controlled space, consistent with American political and economic values, necessarily implies dominion over the environment. The Year Without a Summer was a forceful reminder that environment could not always be controlled.

Is there evidence that the Year Without a Summer challenged Americans on this level? There may be, but like most other effects of the climate anomalies, it is impossible to attribute any one response or group of responses precisely to that (or any other) agency. Certainly it seems that crop failures and other climate-related effects motivated many Americans to emigrate west in 1816-17, particularly to Ohio and parts of New York that would eventually become instrumental in the Second Great Awakening. This migration has been interpreted as a direct response to the climate anomalies.[3] Western emigration in this period doubtlessly would have occurred in the total absence of the anomalies, but somewhere in the complex mix of motivations that spurred families from New England or the Middle Atlantic states to try their fortunes in the West, there might

[2] Alan Taylor, *The Civil War of 1812: American Citizens, British Subjects, Irish Rebels & Indian Allies* (New York: Alfred A. Knopf, 2010), 3-12.

[3] Skeen, 13.

have been expectations that climate conditions elsewhere might be more favorable, less mercurial, and ultimately more controllable. If the Year Without a Summer threatened the assumption that environment was reducible to human will, what better way to answer this threat than to double down and prove that Americans *could* control their physical environment? In this sense it is understandable how speculations on the capability of deforestation and cultivation could change climate could be seen as likely positives rather than negatives. Americans felt destined to tame their continent. This might mean that the climate would change as a result of clearing and cultivation, but as the American project was a positive one, so too must be the ultimate result of that climate change.

There is also in this argument—as with many others regarding 1816—a parallel to contemporary conditions. Today, people in the developed world, and especially the United States, continue to have immense faith in our technological potential. Americans won World War II, put twelve of their citizens on the Moon, and spearheaded the computer and information revolution largely through the use of technology and application of industry. The specter of anthropogenic global warming now poses a challenge to positivist assumptions about the power of technology: here is a literally world-threatening side effect of technological and industrial development, an unintended consequence with the potential to shake our faith in our own prowess and capabilities. Yet many of the proposed solutions to anthropogenic global warming stem from that same trusted faith in technological achievement. We must invest in clean energy, so the arguments go; we will build clean solar plants, harness the energy from the wind or tides, or build more fuel-efficient engines to reduce our collective carbon emissions. Particularly exotic conceptions of climate change solutions are even more unabashedly

optimistic about technological solutions: molten salt batteries, fusion reactors, carbon scrubbers. Like responding to the 1816 climate changes by moving west, these proposed solutions show a propensity to double down and increase one's faith in the very assumption that is being challenged.

C. The Year Without a Summer as a Challenge to Historiography

It is difficult to avoid the conclusion that historians have largely missed the opportunities for historical understanding that the Year Without a Summer presents us. In the past fifty years, only one scholarly book has been published on the subject, and it did not purport to be a comprehensive history.[4] Despite the evidence presented in this paper that the 1816 climate anomalies carry significant implications in the realms of political, cultural, scientific and religious history, historians have almost wholly conceded the field of scholarly writing on this topic to scientists, whose interests lie in examination of the physical causes and effects of the phenomena.

This unfortunate oversight has had the effect of skewing understanding of the Year Without a Summer in two unproductive directions. The first is the implicit assumption that it's not worth discussing; that, interesting though it might be because of the unusual nature of the weather manifestations or the *Frankenstein* connection, it is an irrelevant anomaly that happened and went away, without leaving much in its wake. All narratives of the Year Without a Summer necessarily begin (and most end) with weather, and we

[4] Post, *The Last Great Subsistence Crisis*, was primarily an economic history and focused mostly on the political and economic aftermath of the Year Without a Summer in Europe. The Stommels, who wrote *Volcano Weather*, are not historians. Although their book contains useful historical information, it is not sourced or indexed in a manner consistent with scholarly history and appears to have been aimed largely at a popular audience. *Volcano Weather* was expanded from a 1979 popular science article whose main goal was to advance the argument that the 1816 climate anomalies were indirectly responsible for the worldwide cholera epidemic of the early 1830s.

tend to think of weather events as temporary, ephemeral and not very consequential once they've passed. A thunderstorm or even a snowstorm breaks upon us and may cause considerable havoc in the short term, but once the clouds clear or the snow melts we relegate the event in our minds to a comfortably compartmentalized past. This is the way the Year Without a Summer has been thought of. The lack of historical attention reinforces the sense that there's no "there" there.

The second false direction invited by historians' disinterest is to create the impression that the main value of the Year Without a Summer is as a generator of colorful folklore. The prevalence of folklore in accounts of the climate anomalies is unavoidable, and was noticeable from the occurrence of the events themselves; the repetition of the story about Joseph Walker's foot being amputated from frostbite is a case in point.[5] But a void in bona fide historical analysis of the event abandons the subject to superficial accounts, aimed at popular audiences, that often consist of nothing *but* folklore—the classic "Reader's Digest" approach, which has been unintentionally mirrored in the treatment of the Year Without a Summer on the Internet. Although examination of the folklore aspects of the Year Without a Summer would undoubtedly be a useful endeavor if undertaken by scholars *of* folklore, the lack of substantive historical scholarship about the events themselves fosters the erroneous impression that most of what people have heard about the summer of 1816 is exaggerated or made-up, and that investigation of the facts would likely reveal the event to have been of much smaller magnitude and importance than the "tall tales" make it seem. In fact, many things that might be dismissed as "tall tales"—the rain of stones in Westchester, Pennsylvania, for example—

[5] *Reporter* (Brattleboro, VT), September 17, 1816, 3.

really did happen. In a realm where snow really did fall in June and other seemingly improbable things are documented and verifiable, it is easy to overlook what is really there.

How and why did popular conception of the Year Without a Summer—the public memory of the event—develop largely without the participation of historians? It may be because the issues it raised were nascent and potential rather than direct and observable. Even if one assumes, for example, that the Year Without a Summer had the potential to challenge American exceptionalism or the notion of climatological patriotism, it does not seem to have sparked any public discussion along those lines. Americans did not have to debate the implications because most of them did not come to pass. The political and ideological constructs of society in the Early Republic had enough potential existing fracture points—slavery, economic conditions and the changeover to a market economy, gender relations—without taking on hypothetical challenges arising out of environmental conditions that no one could control. Similarly, the debate about global warming versus global cooling remained largely academic, because the climate did not change enough, in one direction or another, to make a reckoning with the effects of climate change an imperative or urgent matter. Because discussing these questions served no clearly identifiable political or cultural purpose at the time, historians have tended not to raise them after the fact. This left the undeniable public fascination with the events themselves unaddressed by professional interpreters of the past. Public memory needed to include the Year Without a Summer on some level, but its ephemeral nature made it unproductive to serve the objectives or satisfy the professional curiosities of historians. Consequently, the

cold summer of 1816 was inducted into public memory as a form of folklore rather than history.

By reclaiming the Year Without a Summer from scientists and folklorists, historians have the opportunity to make an important contribution to environmental history and the broader understanding of human relationships with Earth's climate in the fairly recent past. This paper has already sought to demonstrate the relevance of this inquiry to modern issues of climate change. This contemporary relevance merely underscores the need to address a peculiarly blank spot in the historiography of the early nineteenth century. Hopefully, this paper is a small step forward in that process.

D. Unanswered Questions: What Remains to Be Explored

Given the fact that volcanic activity is a permanent condition on this planet, and has been since its formation, we would expect to see other examples of episodes similar to the Year Without a Summer throughout history. Indeed, volcanoes erupt quite frequently, and the mathematical odds of a truly catastrophic eruption—the size of Tambora or greater—are a virtual certainty over a long period of time. Why, then, is the historical record not rife with such events? Why is there only one unequivocal example of human response to rapid volcanic-agency climate change in the period of recorded human history? We likely have such a catastrophe in the very distant human past—that being Toba—but is the human race just lucky that the only time it has happened since the advent of writing and archival memory was in 1816, and that it was a comparatively mild case, at least compared to Toba?

The answer may be that it *has* happened before, and on a much larger scale than in 1816, but we don't quite recognize it for what it is. Near the turn of this century, scholars began re-examining various episodes in the past in the context of rapid climate change events. Wherever telltale signs of volcanic climate anomalies—strange severe weather shocks, oddly-colored or acidic precipitation, unexplained periods of darkness or fogs, etc.—appear in the historical record alongside widespread upheavals such as wars, plagues or famines, a historian may be looking at a candidate for a volcanically-induced rapid climate change event. One may take, for example, the chaos of late antiquity. Historical sources in China and the Middle East speak of the light of the sun being blotted out for eighteen months during 535 and 536 A.D., a period that coincides with massive population shifts, catastrophic wars and the genesis of a worldwide plague pandemic that historians have named the Plague of Justinian after its most famous victim (and survivor), the Byzantine Emperor Justinian I. The same ice cores from opposite poles of the Earth from which we deduce the "Mountain X" eruption of 1809 contain an exceptionally thick layer of volcanic fallout indicating a catastrophic eruption in 535 or 536 A.D.[6] There is also speculation that a great famine that swept Europe in 1315 might have been linked to some sort of volcanic event.[7] Although the culprit volcanoes have not been identified, these episodes, if they can be substantiated in both historical and geologic records, would represent rapid climate change events several times greater in impact than the Year

[6] David Keys, *Catastrophe: An Investigation Into the Origins of the Modern World* (New York: Ballantine, 1999), 249-66. Keys is not a professional historian and his analysis has not commanded widespread attention among specialists in the period. However, his methodology is generally sound, and in any event it is difficult to dispute the concrete evidence contained in the ice cores that an eruption of extraordinary intensity occurred in the mid-530s. Keys places his own "Mountain X" in Indonesia, in fact suggesting that it may have been Krakatoa.

[7] Norman Cantor, *In the Wake of the Plague: The Black Death and the World it Made* (New York: Free Press, 2001), 74.

Without a Summer. More work needs to be done in these areas to evaluate these hypotheses.

Regarding the Year Without a Summer itself, there are several important avenues that remain to be explored. The first and most tantalizing is the identity of "Mountain X." Assuming for the sake of argument that the 535 and 1315 events were triggered by volcanic eruptions, the dearth of sources from these periods mean that it may never be possible to identify conclusively the volcano(es) involved. By contrast, the positive identification of "Mountain X" from 1809 sources is much more likely. A comparison of weather conditions prior to 1809, between 1809 to 1815, and in the Year Without a Summer may help paint a clearer picture of what was happening to the Earth's climate during this crucial decade and how each separate volcanic event melded together into a cumulative alteration of climate conditions. This would be a particularly interesting inquiry given peoples' notice of cooling conditions even prior to 1816, as evidenced by the global cooling arguments such as Lord Dreghorn's.

Furthermore, the net needs to be cast wider geographically as well as temporally. Both the scientific examination and the folklore approach to the Year Without a Summer have relied primarily on American and European sources. It was in Europe and the United States that most meteorological observations intelligible to western historians tended to be kept, and conversely, it is from these societies that folklore about the event has resonated and made its way into popular culture. But at the same time this was a worldwide event, and identifiable reactions to it cannot have been limited to the United States and Europe. There has been, for example, no sustained analysis of weather conditions during 1816 in China or Japan, both highly literate societies with extensive

documentary records. An investigation into the impact of climate anomalies in the southern hemisphere would be particularly interesting. Records from European colonial powers alone—the British in Australia and South Africa, or the Spanish in Latin America—would be a useful starting point for inquiry, but beyond these lie a host of sources from native and non-European peoples that could help to paint a clearer picture of the global impact of this event. In North America, Native American and Spanish sources—which to date have not been extensively investigated for material pertaining to this topic—would expand the scope of historiography about the Year Without a Summer from its current American and Euro-centric focus.

However these questions are considered, and whatever choices future historians make regarding the appropriate avenues to pursue, it is clear that there is much more about the Year Without a Summer that can and should be explored by academic historians. An event with such close and profound relationships to contemporary environmental issues must not remain a footnote to history, chiefly visible through scientific literature, the occasional popular magazine article, or Internet trivia blogs. The bicentennial of the event, now fast approaching, offers a unique opportunity to focus much-needed historical attention upon it. And, if a slumbering volcano somewhere in Indonesia or elsewhere should suddenly roar to life with sufficient power to cause climate change—as could happen at any time[8]—the world will suddenly be asking, "Has this

[8] Krakatoa—famous of course for the 1883 eruption, but also suspected by some as the volcano involved in the 535-36 catastrophes—has been growing increasingly active in the past few years. Periodic eruptions on "Anak Krakatau," a small volcano formed during the 1883 event, began to capture worldwide press attention in 2007. *See, e.g.*, Supriyatin, "Indonesia's Krakatau Roars, Dazzles with Fireworks," *Reuters*, November 11, 2007, http://in.reuters.com/article/2007/11/11/idINIndia-30436520071111 (accessed April 26, 2012). As of this writing these eruptions continue; one can follow their daily progress, including photos and video, on the Internet. *See, e.g.*, Øystein Lund Andersen, "Personal Homepage and Photography Portfolio," http://oysteinlundandersen.com/index_main.html (accessed April 26, 2012).

happened before, and if so, how did people react?" Historians should be prepared with an answer.

E. Epilogue: Watching the Skies

For some people, the Year Without a Summer never ended. It continued to be replayed again and again in their memories, stories, and consciousness, a strange freezing season that itself became frozen in time. "On the Fourth of July," wrote Chauncey Jerome forty-four years later, "I saw several men pitching quoits in the middle of the day with thick overcoats on, and the sun shining bright at the same time."[9] Jerome died in 1868 at the age of seventy-four, but this image that had stuck in his memory for decades has survived him for far longer than he was alive. An Internet search, conducted in 2012, for the terms "Jerome," "quoits" and "1816" yields over four thousand results.[10] Like a tiny loop of video, the image of the Plymouth Fourth of July revelers in their heavy overcoats repeats in someone's mind every time Jerome's account is quoted or read. The strangeness of the Year Without a Summer and the interest it continues to engender had the extraordinary effect of uploading this image—which once existed only in Chauncey Jerome's head—into the collective public consciousness of America. While there are many far more famous images in American history, one should keep in mind that this is not an iconic image of war, political upheaval, great men and women, or anything that might be far more likely to resonate in historical memory. It's an image of men playing a

[9] Jerome, 32.

[10] Google Search http://www.google.com/search?hl=en&as_q=Jerome+1816&as_epq=quoits&as_oq=&as_eq=&as_nlo=&as_nhi=&lr=&cr=&as_qdr=all&as_sitesearch=&as_occt=&safe=images&as_filetype=&as_rights=not+filtered+by+license (conducted April 26, 2012); results 4,420 hits.

game outdoors on an unusually cold day. Yet it survives, a fascinating example of the persistence of memory, a compelling portrait of the highly unusual event that occurred on planet Earth two centuries ago.

Many Americans were unsure of what was happening to them in that year. Some took solace in the opinion of scientific experts; others were unconvinced. Some worried about their crops; others reassured each other that everything was fine. Some thought the planet was growing warmer, while others insisted the opposite was happening. Some were afraid. Others were hopeful. In the midst of this uncertainty, perhaps all one could do was to watch the skies for some sign, however attenuated, of what might be coming next. One such watcher was Isaiah Thomas, the Worcester philanthropist, diarist and publisher of his own *Town & Country Almanack,* a publication exemplifying the pastiche of knowledge from which he drew his reckoning with the world. In the *Almanack* for 1817, which must have been going to press not long after the summer of 1816 ended, Thomas noted to his readers:

> The following wonderful phenomenon was noticed, Sept. 8, 1816, at Washington, and at other places in the U. States.—The sun was surrounded with a circle, or *halo*, of the usual diameter, but uncommonly bright and well defined; being tinged, especially in its upper or northern part, with prismatick colours…While we are certain that the appearances were the result of the *reflection* and *refraction* of light, yet we cannot conceive of any hypothesis by which we can account for them…this *compound halo* is, we believe, yet wholly unaccounted for by any writer.[11]

The compound halo of the sun seen in September was remarked upon at the time by various newspapers, who attempted to discern from it a harbinger of what the unpredictable climate might do next. “Haloes or circles around the sun,” said the *Daily*

[11] Isaiah Thomas, *Isaiah Thomas, Junior’s Town & Country Almanack, or Complete Farmer’s Calendar, for the Year of Our Lord 1817* (Worcester, MA: William Manning, 1816), 3.

National Intelligencer, "have always been considered as the precursors of rain or snow…and there is scarcely an old woman in the country who will not predict the number of hours to elapse before failing weather, by the number of stars visible within a circle about the moon."[12] In this case at least, the premonition gleaned from sky-watching may have been accurate; the great eastern storm at the end of the Year Without a Summer—most likely a hurricane—began shortly thereafter.[13]

But what did it all mean? How did the people who lived though these events, in all their strangeness and contradictions, come to accept and assimilate them into their understanding of the world around them? There can be no single answer to that question; indeed, a major argument of this paper has been that the multitude of disparate reactions defies any pat conclusions, any easy categorization. There were clearly some in 1816 who took it all in stride. If the climate anomalies were products of nature, wasn't there indeed an argument for treating them not as anomalies at all, but as perfectly normal and ordinary manifestations of much larger natural processes? This was the argument of the *Essex Register* in perhaps the summer's most eloquent editorial, written probably by Warwick Palfray himself, which sought to place the events of the Year Without a Summer into a broader—indeed almost cosmological—context:

> These facts [referring to previous phenomena of solar haloes] are as well authenticated as anything in history. Let no one therefore be astonished, even if the sun should be entirely black, or the moon turn red, or new stars appear, or old ones go out of the system, or earthquakes remove kingdoms, and shake down cities, or mountains vomit fire, or floods inundate countries, or kingdoms change masters, or comets gleam athwart the heavens, or stones fall from the sky, or rain, hail, tempests, hurricanes, water spouts &c. &c. &c. continue to appear; let no one be ignorant of the mighty operations of nature, and though uncommon, are a part of the

[12] *Daily National Intelligencer* (Washington, DC), October 3, 1816, 3.

[13] Ibid.

> system of things; and are no more wonderful than the showers of spring, or the rising of the sun, or the return of winter.[14]

Palfray's eloquence—if indeed he was the author—sought to catch the wild phenomena of the summer of 1816 into a single net of reassurance and faith. In 1816 the sun did not go entirely black, though some feared it might; floods did inundate countries, stones did fall from the sky, and the reports of hail, tempests and things that could be called hurricanes were certainly in evidence. All of it seems to have been brought about by a particular mountain that vomited fire on a spring day in April 1815. But about one thing the author was definitely wrong. Though clearly an example of the "mighty operations of nature," the events of the Year Without a Summer certainly *were* wonderful, as that term was understood in 1816. Had they not been full of wonder, they would not exert the same pull of fascination that they do today, two centuries later—fascination about a winter that did not return, but instead never ended.

[14] *Essex Register* (Salem, MA), August 31, 1816, 1.

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