

PATRICK ANTHONY

Terrestrial Enlightenment: Ruin and Revolution in an Eighteenth-Century Climate Crisis

Abstract

Some scholars and scientists identify the eighteenth century as an inflection point in the Anthropocene, a geologic age in which humans act as a planetary force. This article suggests that this inflection point was characterized not only by new means and scales of environmental manipulation, but also by the development of climate politics. Where forests have been the focus of considerable scholarship on eighteenth-century environmental policy, this article turns to hydrology as a theater of material and discursive engagement with the era's most palpable climatic threat: deluge. Catastrophic floods, like that which followed the eruption of Iceland's Eldeyjar and Lakagígur volcanos in 1783/84, show how climate took its place in the enlightenment "culture of disaster," which shifted responsibility from divine to terrestrial authority. Under the rubric of terrestrial enlightenment, I propose a framework for understanding the broad assemblage of artifacts, environments, and imaginaries that constituted late-eighteenth-century climate politics. Encompassing natural resources, infrastructure, and even ruins, terrestrial enlightenment integrates a corresponding range of naturalists, chroniclers, engineers, scholars, artists, and politicians. The naturalist Georg Forster provides an especially rich archive of this time, from his study of Saxon hydraulics in the wake of the flood of 1784 to his death in Paris during the Terror of 1794. On either side of the Rhine, resource management and disaster mitigation materialized political power.

In a global state of precarity, we don't have choices other than looking for life
in this ruin.

Anna Lowenhaupt Tsing, *The Mushroom at the End of the World*, 2015

What, exclaimed I, is that the earth that is inhabited by human beings?

Constantin François Volney, *Les ruines*, 1791

The late eighteenth century was an age of climate crisis. The atmospheric chemist Paul Crutzen suggested 1784 as a plausible start date for the Anthropocene, a

geologic age in which humans act as a planetary force, noting how increased levels of carbon dioxide and methane “coincide with James Watt’s design of the steam engine.”¹ But the fossil fuel economy was only beginning its uneven, and by no means inevitable, path toward the climate emergency in which we now live.² Environmental disaster took another form that year. In May and June of 1783, the eruption of Iceland’s Eldeyjar and Lakagígar volcanos sent a sulfurous plume of ash across Europe and into North Africa and Central Asia. The sun and moon shone “like blood” in the hazy summer sky, an English miller reported; butcher’s meat spoiled in a day and flies drove horses “frantic.” Lakagígar was still active in January 1784, when the blood-red veil turned to “black fog,” as one Bavarian wrote, “fetid and suffocating.”³ Another recorded hungry wolves descending on towns and villages after a stormy summer and fruitless harvest.⁴ Barometric records, too, show the early arrival of a severe and snowy winter across Europe, with uncommonly deep and persistent low-pressure systems.⁵

Still more threatening than the cold alone, however, was the rapid fluctuation of cyclonic and anti-cyclonic days in the meteorological archive. On February 24 warm southerly winds induced a sudden thaw of the heavy snowfall and frozen rivers, unleashing massive floods in the major river basins of western and central Europe. “When were the winds/Let slip with such a warrant to destroy,” the poet William Cowper asked of his age: “When did the waves so haughtily o’erleap/Their ancient barriers, deluging the dry?”⁶ The deluge destroyed dikes, mills, and bridges across the Continent, inundating cities from Brussels to Vienna. Extreme weather was common enough in eighteenth-century Europe.⁷ But the quick succession of quakes, floods, and “portentous” meteor showers in the mid-1780s impressed Cowper and his contemporaries with a new sense of instability on earth, “her shaking fits more frequent, forgone her usual rest.” In the decade that followed, climatic extremes unfolded on a planetary scale, with considerable influence on the age of revolution.

What Eric Hobsbawm described as the onset of a “dual revolution” in Europe’s politico-industrial modernity is here reconsidered as a “dual crisis” in the established socio-environmental order.⁸ This means that while erratic climatic conditions exerted exceptional pressure on ruling powers, the threat of regime change was bound up in disputes over resource management, disaster mitigation, and indeed anthropogenic climate change. Richard Grove’s path-breaking studies of El Niño patterns have revealed the late eighteenth century as a time of extreme meteorological volatility, inflected by volcanic eruptions in Japan, Italy, and Iceland.⁹ A decade that opened with crop failures in Britain and India in 1782–83, compounded by the volcanic winter of 1783/84, ended with the “Great” El Niño events of 1790–94, which caused droughts and catastrophic loss of life in Mexico, Egypt, and Australia. These events shocked global economic systems and impacted the course of revolutions in France and Haiti. Hailstorms decimated the French grain economy in 1788–89, and a prolonged Caribbean drought gave way, in the mid-1790s, to malarial conditions that stifled European attempts to re-enslave Haiti’s free Black citizens.¹⁰ If climate acted *on* revolutions, it also acted *through* them, especially as Republican policies intensified the clearing of woodlands in France. Jean-Baptiste Fressoz and Fabien Locher among others have shown how Revolution and Restoration elevated widespread anxieties about “timber shortages” in Europe to a “climatic

concern,” as partisans blamed new and old regimes for the adverse atmospheric effects of de-forestation.¹¹ Notably, the de-regulation of forests according to market principles coincided in the 1790s with a growing association between denudation, soil erosion, and catastrophic flooding. This is an important reason why revolution itself came to be seen as a natural disaster.¹²

If the enlightenment was an inflexion point in the Anthropocene, as several scholars suggest, it should account for how climate crises came to be seen, like other disasters, as political matters.¹³ This article examines the development of climate politics in the 1780s and 1790s, from absolutist German states, across the Low Countries in revolt, to republican France. It focuses on hydrology (with its links to water-powered industries, meteorological phenomena, and forest policies) as a theater of material and discursive engagement with the era’s most palpable climatic threat: deluge. Under the rubric of *terrestrial enlightenment*, it proposes a framework for understanding the broad assemblage of artifacts, environments, and imaginaries that constituted late eighteenth-century climate politics. Encompassing natural resources, infrastructure, and even ruins, terrestrial enlightenment integrates a corresponding range of naturalists, chroniclers, engineers, scholars, artists, and politicians. What bound these actors together was the sense that resource management and the mitigation of environmental catastrophe materialized political power. If the “Highwater” of 1784 posed a threat to old regime states, hydraulic engineering exercised restorationist politics in the wake of the flood. This can be understood as a form of hydrosocial sovereignty.¹⁴ By the same logic, however, the challenge liberals posed to states’ exclusive regulatory powers over water and wood also registered an assault on their political hegemony. Popular images of revolution as an eruption, avalanche, or flood were not merely metaphorical. They recognized states as terrestrial entities, whose authority hinged on the capacity to “moderate” environmental extremes. Thus, the young French Republic came to be seen as a state of climate precarity.

This exploration of terrestrial enlightenment takes advantage of the rich archive compiled by the German naturalist Georg Forster (1754–94). Better known for his narrative of James Cook’s second circumnavigation in 1772–75, Forster also provides a helpful itinerary through a decade of dual crises, from his study of Saxon hydraulics in summer 1784 to his death in Paris during the Terror of 1794. I use that itinerary to expand and revise a genealogy of earth-oriented politics for which Bruno Latour has suggested a provocative starting point: the *Cahiers de doléances* (ledgers of grievances) drawn up by France’s three estates in spring 1789. As Latour observes, the *Cahiers* show how a socially heterogeneous collective conceived of its social and political existence on the basis of terrestrial conditions. This conception included a significant critique of the destruction of forests that fueled the fiscal-military state and increased wood prices. “The terrestrial question was also one of regime change,” Latour wrote, “monarchy or republic.”¹⁵

Forster’s own writings on timber shortages in the Rhineland show the geopolitical scale on which it was possible to pose the “terrestrial question.” A year after the *Cahiers* were collected, Forster speculated that the fuel crisis around Aachen portended a “general revolution in Europe, which would bring about the collapse of political, moral, and scientific forms.”¹⁶ Sure, he reckoned, “nature has provided the inhabitants with overabundance in subterranean forests,” noting the regional shift from wood to coal fuel, and “everything seems to

promise the endurance of our current . . . political circumstances.” “But what if the pits are exhausted?” This eventuality, already forewarned in Britain, seemed to hasten the end of the old regime. It also threatened to make Europeans climate refugees who would “depart the lands of ice and fog and the regions of the so-called temperate zone, leaving it completely denuded and uninhabitable.”¹⁷ At what seemed a quite literal end of enlightenment, environmental disaster was understood as anthropogenic and inherently political. The link between denudation and revolution seemed so self-evident that Forster felt little need to explain it.

Doing so means integrating two frequently unrelated fields of scholarship: histories of resources and histories of disasters. On the one hand, Forster amplified the “regulatory crisis” that Joachim Radkau describes in eighteenth-century Europe wherein autocratic states raised alarms about imminent resource depletion (especially *Holz-mangel*, the supposed timber shortage) to extend dominion over natural systems.¹⁸ Royal forestry provides one of the most cogent illustrations of how interventions in the environment materialized both state power and its opposition. The “sustainable” measures by which states restricted popular access to forests sparked protracted, sometimes violent conflicts.¹⁹ On the other hand, Forster invoked what Marie-Hélène Huet described as enlightenment’s “culture of disaster,” which reconceived catastrophes, especially earthquakes and epidemics, as political rather than providential events.²⁰ The cultural reinvention of catastrophe thus shifted responsibility for “natural” disasters from the divine to terrestrial authorities. Forest disputes were also closely linked to the economics of disaster, since “war-states” like France, Prussia, and Saxony felled woodlands to fuel the iron industries that supplied their standing armies and sold timber to alleviate the enormous debts incurred by war finance.²¹

But it is water, even more than wood, that most clearly exhibits the interstices of resource politics and disaster culture, and floods, more than earthquakes or epidemics, show how climate took its place among the catastrophes that haunted eighteenth-century political speculation.²² In turn, histories of water management show how economic and philosophical forecasts of disaster were embedded in practical efforts to avert catastrophe. Here was an artifactual sense of politics, enacted in weirs, water-pumps, and canals that might serve restorationist and revolutionary agendas. Historians have shown how power flowed through systems of canalization, irrigation, and drainage in the early modern world, though often diverted and contested in the process.²³ Like forestry, water management became integral to statecraft after about 1750, marking the beginning of a “hydrological revolution” in Germany and across Europe. “Look at how German waterways were remade,” David Blackbourn wrote in his remarkable history of the nation’s fluid transformation, “and you see where the lines of power ran.”²⁴ You also see where lines of power faltered, since climate crises manifest most forcefully on the Continent in floods. German waterways are precisely where Forster looked in the spring of 1784 when he traveled first to the reservoirs that stored hydraulic power for mines in the Harz Mountains and then to the industrious tributaries of the Elbe in Saxony. From Saxony amid ruin, the article follows Forster to manufacturers in the Rhineland and the “humbled waters” of Flanders in 1790 and, ultimately, to Paris where a frozen Seine registered the climate of Revolution.

Chronicling Deluge

The Highwater of 1784 marked the confluence of climate politics and disaster culture. While climate became a measure of civility in the later eighteenth century, disasters shook and tested the durability of ruling powers. Around mid-century, climate was integrated into European political thought as the sum of the atmospheric and environmental conditions understood to determine physiological, moral, and intellectual diversity among human societies.²⁵ By the 1770s, naturalists and statesmen increasingly viewed a society's capacity to manipulate and "moderate" climate as evidence of its preeminence.²⁶ In 1778, the naturalist Buffon measured the superiority of France and Germany by the extent to which they had "cut down the forests, drained the swamps, contained the torrents, directed the rivers, and cleared all the lands that were covered and charged with the debris of their production."²⁷ In repairing nature's ruin, he believed European "civilization" forestalled a cooling earth, a view that gained traction in the supposed "wastelands" of North America, where colonists read apparent warming trends as justification for the dispossession of Indigenous populations.²⁸ But the same logic that made climate a theatre of power politics also meant that environmental disasters—earthquakes, storms, floods, and droughts—posed a threat to the foundations of a state. As Huet has argued, the Enlightenment did not simply "naturalize" disasters. It "also did away with the idea of a purely natural disaster" and shifted responsibility from the divine to terrestrial authority.²⁹

These currents converge in Forster's call not for a social but a natural contract. Begun as a lecture in Kassel in 1779 and drawn from Buffon's writings the previous year, Forster's 1781 treatise *A View in the Whole of Nature* accorded "rights" to non-human nature. Man's "government" of nature "is more indulgence than entitlement," Forster argued, for "he must continually renew his care . . .":

so soon as he stops, everything languishes, decays, and transforms; all returns to the realm of Nature: she reclaims her rights [*sie tritt wieder in ihre Rechte*], obliterates the works of Man, covers his proudest monuments with dirt and moss, destroys them entirely with the passage of time, and leaves him nothing but the agonizing vexation of having lost the hard-won property of his ancestors.³⁰

The passage suggests how disasters could function as referenda on existing power structures. Those structures were instantiated in the "works of Man" and his "monuments." By this Forster meant infrastructure and energy systems such as the roads, bridges, and hydraulics besieged in 1784.

Forster kept a diary in the wake of the flood, which he intended to publish as a travel narrative. It, too, was a study in the ephemerality of human labor amid the ruinous forces of nature and time. The diary began in late April with a recapitulation of the winter's events in an affective climatography. Nearing the foothills of the Harz Mountains, Forster's mirthful "sentiments on the clouds" quickly proved as "illusory" as the "apparition of sunshine." Soon the sky blackened, and I heard the roar of Zeus gathering the clouds.³¹ Ascending toward the mining center of Clausthal-Zellerfeld, Forster's mood dipped apace with the barometer he used to gauge the gathering storm. "The storm does not merely rage in the pine wood; it tears inside me," he wrote of the lashing winds and

hail of a springtime blizzard.³² The pathos of a sentimental journey served to chronicle the human condition in an age of extreme weather. All the more remarkable seemed the industrial settlement of Clausthal-Zellerfeld, as if to defy a hostile climate: “in the midst of the Harz wasteland, in the midst of the black morass of forest, a place inhabited by men?”³³ What a contrast, too, the diluvial ruin in Germany’s flood plains made with the intricate system of dams, sluices, holding ponds, and hydraulic pumps that characterized ore mining in the Harz. Forster described one particularly “beautiful dam” as a “magnificent work whereby two mountains were united into a 3rd, artificial one.”³⁴ Here was the “built nature” he had envisaged in his 1781 treatise, “a new, rejuvenated Nature [that] springs forth from our hands!”³⁵

The diary can be read within a wider print and visual culture preoccupied with the human capacity to stem the tide, as it were, or be swept away. By June, when Forster made his way to Dresden, the Elbe had settled into its regular course “deep between the high, steep banks.” Yet its glassy surface reflected recent history, like a “mirror” in the moonlight: “villages and steeples along the opposite bank, trees and dwellings, all stood in the water.” The flood left more tangible evidence upstream at the porcelain manufactories in Meissen. There, Forster witnessed the “piteous” state of a bridge “ruined entirely by water and ice,” and crossed the Elbe on a temporary barge.³⁶

It was an iconic scene among artists that spring, who depicted stately bridges burst by the rivers Main in Bamberg, Neckar in Heidelberg, and Vltava in Prague (Figures 1-2). A gazetteer in Liège described how a torrent of ice blocks threatened the “total ruin” of towns along the Maas.³⁷ In Cologne, the swelling Rhine overcame Cologne’s 29-foot protective dikes, reaching a high-water mark of 40 1/2 Prussian feet, shown as an anomalous spike on hydrographic atlases.³⁸ Eyewitnesses spoke of graveyards exhumed by the floodwaters of the Elbe, a flotilla of coffins carried downstream. Others described entire mills swept away, their inhabitants caught in the current.³⁹ Some would call it the Highwater or Ice Flow of the Century. But according to a study by the Leipzig Economic Society, it had been a 283-year event in Saxony, as the Elbe hit high-water marks of 12 *Ellen* (18 feet) unmatched in Dresden and Meissen since 1501 (Figure 3).⁴⁰

The Elbian study belongs to a genre of “Diluvial-Chronicles” popular in Germany in 1784 and sometimes presented as “public monuments.”⁴¹ Monumentalization was a mode of chronicling catastrophe, an idiom of endurance that betrayed an acute sense of vulnerability. The naturalist Christian Gottlieb Pötzsch read Dresden’s diluvial history in inscriptions and plaques mounted on various edifices throughout the city, which he used to measure the flood of 1784 against the high-water marks of centuries past. “The Elbe-Ice broke, great waters flowed,” began a verse of 1595, mounted on the altar of a Neustadt church; “Such is to be inscribed as a monument.”⁴² Chronograms registered a yearning for stability in what Nina L. Dubin has called a “time of contingency.”⁴³ Engraved on bridges and buildings to indicate historic high-water marks, these “time-writings” encrypted the flood’s date in scrambled numerals. The disaster of 1784 was memorialized on Dresden’s Wilsdruffer Gate. When crossing the Elbe to pass under the city walls from the west, one read the inscription:



Figure 1. Ruins of the Alte Brücke in Heidelberg, part of Ferdinand Kobell's eight-painting cycle of 1784. G 383, © Kurpfälzisches Museum Heidelberg, Photo: K. Gattner.



Figure 2. Ruins of the Neumühle in Heidelberg, by Kobell. G 382, © Kurpfälzisches Museum Heidelberg, Photo: K. Gattner.



Figure 3. Table of highwater marks from Christian Gottlieb Pötzsch’s *Chronological History of the Great Floods of the Elbe since a Thousand and More Years*. Münchener DigitalisierungsZentrum (MDZ), Digitale Bibliothek.

FVRCHTBARER, ALS VOR ZWEI HVNDERT DREI VND ACHTZIG
IAHREN

[more terrible than two-hundred and eighty-three years ago⁴⁴]

But as Pötzsch’s 1786 addendum observed, even the memorials of 1784 were outdone the next year, as marked by a chronogram on the Brühl Library terraced high above the Elbe’s banks:

ALBIS AQVAS QVO SVSTVLERAT VIGESIMA SECVNDA APRILIS
[To this height the Elbe raised its waters on 22 April⁴⁵]

Such “*Monumente*” inaugurated a new age of extremes with daunting similarities to catastrophes past. The high-water marks of 1784–85 were challenged again in 1786, even as drought stopped millwheels altogether in England.

The chronogram’s conceit, to impose fixity on contingency, was reflected in the restorationist programs of central Europe’s paternalist rulers. In publicizing those programs, Germany’s Diluvial Chronicles engage a wider global history of eighteenth-century disaster politics. If natural disasters threatened the status quo, imperial rulers and colonial governments also saw storms and quakes as opportunities to shore up their position as sole providers of aid. In doing so, they reinforced particular forms of life and subjecthood. The Imperial Qing State, for instance, provided Mongolian subjects, scattered by snowstorms and floods on

the steppe in the 1730s and 1740s, with forms of disaster relief meant to alienate pastoralists from their nomadic identity.⁴⁶ Other rulers blamed natural disasters on the “degeneracy” of their Indigenous subjects, as when the Viceroy of Peru used the earthquake-tsunami of 1746 to expand the hegemony of Bourbon reforms in Lima.⁴⁷ After an earthquake devastated the Persian city of Kashan in 1778, poets invested the governor, who ordered its reconstruction, with cosmogonic powers after having seen “the order of the world restored.”⁴⁸

German chroniclers played a similar part, seeing in the authoritarian governments of Saxony and the Rhineland an edifice capable of enduring ruin. German states paid increasing attention to coastal and inland floods after about 1750, as evidenced by the new scale of dike-building and canalization projects.⁴⁹ Pötsch’s Elbian epic was itself hailed as a history drawn “from the archive of an awakening patriotism.” This was a patriotism of reformers, not revolutionaries, current among the lesser noble and bourgeois men who filled the ranks of royal scientific academies and civil service in old regime Germany.⁵⁰ Ernst Ferdinand Deurer, a member of the Academy of Sciences in Mannheim (at the confluence of the Rhine and Neckar), included in his chronicle the seven-point aid policy decreed by the Academy’s “benevolent father,” Elector Karl Theodor, whose reign in the Bavarian Palatinate was already marked by infrastructural reform.⁵¹ The Elector’s measures were administrative and apparently self-sacrificing; he dispensed aid to those affected by the inundation through special bureaucratic commissions, without levying “extraordinary” taxes. But it was the Elector’s forestry administration (*Oberforstamt*) that evoked Deurer’s most patriotic sentiments and recalled the Germanic defense of the “Fatherland” against Roman invaders. In these terms Deurer described the felling of royal forest reserves to provide firewood in an uncommonly frigid winter of 1783/84, especially to river-dwellers whose own stockpiles were swept away. As Deurer reported, such forms of disaster relief inculcated solidarity in the Palatinate order of estates and deference toward its paternalist authorities. This ideal was replicated in the “heart-stirring sight” of private charity led by the patrician class, as “men of high rank stood beside common citizens” to deliver aid to the flood victims.⁵²

Others read a different sign in the flood of 1784, hinting at the widespread conflict caused by the exclusion of “common citizens” from forests marked out for state-run industries or sold as a source of royal revenue. In the 1770s and 1780s, meteorologists in Europe and its colonies began to associate climatic variability with deforestation, while practical experts became increasingly sensitive to the relationship between the clearing of forest and the frequency and intensity of flooding events.⁵³ This raised one of the era’s most pressing environmental questions: were territorial states the root cause of deforestation and its hydroclimatic effects? Or did statist programs of environmental stewardship guard subjects against the worst of these ills? An anonymous Bavarian chronicler elevated such questions to a general inquiry about the fate of society, which seemed to him far more fragile in the wake of the flood than Deurer let on:

Verily, this atrocity and desolation has dealt a heavy blow to the entire economic system [*wirtschaftliche Sistem*]. All the more reason it should spur us to industry, and to frugality this one true source of prosperity. Perhaps such a remedy is required of our age, when on the one hand civic spirit and craft-zeal,

begin to dissipate by and by, while on the other hand luxury and wastefulness run so extraordinarily rampant.⁵⁴

Though the precise “remedy” is left unsaid, the passage identifies the flood of 1784 as an event that not only impinges on the “entire economic system,” but which might be averted by its reform. The chronicler applied a popular eighteenth-century logic of “œconomy” to the state of environmental ruin, which correlated excesses of social and natural kinds. Frugal industry (e.g., thrifty use of wood and water resources) implied moderate climate.⁵⁵

Frugal industry is just what Forster found after leaving Dresden, enacted in the hydraulics along the River Mulde, a tributary of the Elbe that powered mining operations around Freiberg. As in the “Harz wasteland,” Saxon mining seemed a counterweight to the winter’s extremes. Accordingly, Forster found in Johann Friedrich Mende (1743–98), the hydraulic engineer who guided him along the Mulde’s banks, an embodiment of the social archetype he’d envisaged in 1781: an “instructed individual” who, by accumulating the “experiences of many centuries,” transcends the finitude of human life and the ephemerality of human labor.⁵⁶ At the terrestrial assembly of Forster’s imagination, he was a “representative of the species.” And not for the last time, Forster’s polemic took hydrologic form: “Amidst the currents of time, whose ebb and flow swallows up all individual things in this world, he sees the species everlasting, and Nature unchanging.” This was also the creed of technicians whose arts of endurance (or *Dauer*) materialized the hydrosocial sovereignty of the Saxon state.

Arts of Endurance

Forster surveyed scenes of disaster and durability in the Mulde Basin and provided an architectural study of Saxony’s “shared dominion with Nature.”⁵⁷ Contemporaries viewed Freiberg’s mines and mechanical arts in much the same way as they viewed ancient ruins—as “power structures in need of constant fortification,” to speak with Julia Hell’s history of ruin-gazing.⁵⁸ In an age when, as Cowper wrote, the very “pillars of our planet seem to fail,” the Old Father’s Aqueduct in Halsbrücke, near Freiberg, appeared as a testament to the region’s well-tempered hydraulic economy, poised as it was above “the mass of rock through which the Mulde violently forged its path.”⁵⁹ Built about a century beforehand, the “picturesque archway of hewn stone” appeared to Forster as a ruin-in-action, “communicating the force necessary for the movement of machines” in distant mines. In fact, travel handbooks described the “Roman Aquäductus” as a “ruin” even before it ceased to operate at the end of the century, when artists came to embellish the structure’s decay and overgrowth in scenes of Saxon arcadia (Figures 4-5).⁶⁰ The production of Saxony’s industrial antiquity belongs to a wider engagement with ruins, in Nina Dubin’s words, “less as remnants of a disappearing world than as proof of a precarious one.”⁶¹

Precarity abounded on the Mulde’s banks, too. From the aqueduct, Forster turned to the “monstrous chasm” of a collapsed shaft (miners said: *Pinge*) on the well-worked slope above the Mulde. Echoing the natural contract he had drawn up in 1781, Forster “shuddered” at the “terrible ruin which Nature can bring upon the works of men . . .”:



Figure 4. The partly dismantled Altväterwasserleitung in Halsbrücke, by Adrian Zingg, 1790s. The structure is captured in picturesque style even as its wooden components remain in place on the far bank and across the top. Kupferstich-Kabinett, Staatliche Kunstsammlungen Dresden, Inv.-Nr. A 131949, Photo: Herbert Boswank.



Figure 5. A still more ruinous view from the opposite bank of the Mulde, by an unknown engraver in the earlier nineteenth century. Author's collection. The print is likely based on a popular engraving by Ludwig Richter from 1822 (see Kupferstich-Kabinett, Staatliche Kunstsammlungen Dresden, Inv.-Nr. A 1995-5711, cf. nt. 60).

pressure builds upon the heaps of rock; and the burrowed passages under the earth, too carelessly framed, cave in, bringing death and desolation in its collapse, leaving behind not a single trace of their former industry.⁶²

To the reading public he had in mind, the “chasm” channeled the Lisbon quake of 1755. The enlightened indictment of the city’s builders was a watershed in the re-invention of disaster as a social as well as natural phenomenon.⁶³ Similarly, in Halsbrücke, a mine “too carelessly framed” would, in Forster’s words, infringe upon the “rights” of Nature itself. Man must “continually renew his care” to retain terrestrial sovereignty. But that is also why Forster concluded the passage by envisioning the ruin’s restoration. Coached by the hydraulic technician who guided him through the Mulde Basin, Forster described how new “pumping engines” may yet “revive this historically significant mine, and free its depths of inundation.”⁶⁴

Forster’s guide, Mende, Freiberg’s first Master of Machines (*Kunstmeister*), sought technical solutions to the problem of ruin. His mechanics were specifically designed to moderate the era’s precipitation extremes. A newfangled Water-Saving Pump, for instance, which began its operation the day Forster arrived in the Harz, was to “remedy the ever-increasing shortage of water-power . . . for the entire future.”⁶⁵ Like timber reserves meant to reinforce princely authority in the devastating winter of 1783–84, hegemony over the Mulde watershed was to “sustain” that of the Saxon Mining State (*Bergstaat*). The Electorate of Saxony faced ruin not only in the form of a 283-year flood but also in the economic devastation of the Seven Years War (1756–63). Saxony suffered severe territorial and fiscal losses at the hands of Frederick II’s Prussia, inducing a structural crisis in its metallurgic industry.⁶⁶ The Elector looked to a reformed mining bureaucracy to restore order and founded the Mining Academy in Freiberg in 1765 to cultivate a new “administrative elite.”⁶⁷ *Kunstmeister* Mende was the Academy’s second graduate, following Forster’s host in the Harz, the Mine Captain Heinrich von Trebra. Trebra heralded Mende’s mechanics as a “new epoch” in the use of waterpower, lauding the “perfect regularity” and “consistency” of his hydraulic apparatuses in the face of timber shortages, high coal prices, and hydrological variability.⁶⁸

If Mende’s mechanics signal a new epoch, the exercise of governance through water management was both generalized and precedented. In this history, expansive water infrastructures sometimes reveal a devolution of authority from commercial and imperial centers to disparate communities with privileged knowledge about annual flood cycles and the workings of sluices, dikes, and catchments. In the intricately irrigated Egyptian Fayyum, for instance, which cradled the waters of the Nile and the Ethiopian Highlands, traditional vectors of Ottoman power had little influence compared to the village elders (*ehl-i vikūf*) on whose flood warnings a global grain trade hinged.⁶⁹ Similarly, in the Dutch Republic, village *Waterschappen* coordinated canal maintenance with regional authorities, leading some historians to correlate the distribution of political power and the “democratic-cooperative” nature of social life on reclaimed land.⁷⁰

Aggrandizing European states and their imperially networked trade companies therefore recognized water infrastructure as a means of consolidating power, if not expanding their dominion. Hydraulic engineering developed accordingly

in old regime Europe as an apparatus of the fiscal-military state, much like the mining and forestry sciences required to sustain artillery and arms production for standing armies. The *politique d'eau* devised in the court of Louis XIV, for instance, made canal commissions and river navigation a major agenda of the French state, whose naval shipyards demanded an ever-greater supply of timber.⁷¹ By the eighteenth century, Joachim Radkau wrote, “European politics in general acquired a hydraulic dimension.”⁷² In peacetime, too, rulers enrolled hydraulic engineering into state-building projects, quite literally in the case of massive land reclamation schemes. Iconic are the hydrological designs pursued in Frederician Prussia (r. 1740–1786). As David Blackbourn observed, plans to drain, colonize, and farm Prussia’s Oder Marshes “amounted almost to a parody of the desire to order a disordered world, to impose a machine-like regularity.”⁷³ By the second half of the eighteenth century, when the manipulation of the physical environment signified “civilization,” hydraulics joined forestry as practices of enlightened statecraft.

Mende’s management of what he called the Waterpower Economy rested in his exclusive claim to regulatory powers, echoing the priority claimed by state foresters. In both cases, officials leveraged the long-term interests of the state—what foresters called “sustainability” (*Nachhaltigkeit*) and Mende called “durability” (*Dauerhaftigkeit*)—to justify the stewardship of wood and water resources that “commoners” and private industry might otherwise pillage or divert into scarcity. Rivers crowded with mills, like forests coveted for fuel, may not have betokened the ecological “emergency” that states used to broaden their jurisdiction, but they did signal a regulatory crisis among competing interests.⁷⁴ Competition over forests was mirrored in the “Water-Conflict” waged between the miners and millers who relied equally on the Mulde.⁷⁵ Freiberg millers had long complained about the “certain ruin” they faced when extractive operations destabilized the Mulde’s flow.⁷⁶ The proliferation of new water-pumps, wheel-driven stamp mills, and ore washes under Mende’s administration entailed a still greater distribution of the Mulde’s increasingly irregular flow through an expansive network of canals and underground tunnels. This new hydraulic landscape corresponded, therefore, to a new hydraulic politics: a water tax to regulate the consumption of drinking water in Freiberg.⁷⁷ The tax instituted a new metric that quantified hydraulic flows in the unit of a *Rad* (the amount required to turn a wheel) and literally imposed a “machine-like regularity” on Saxon watersheds.

Forster thought Mende’s regulatory program most clearly manifest in the weir and waterworks installed at Gersdorf, some 25 kilometers downstream of Halsbrücke (Figure 6). Here, accompanied by the Mende, Forster studied the art by which the *Kunstmeister* attempted to moderate hydro-climatic extremes. Against a wider backdrop of diluvial ruin, he marveled at the steadfast weir—“an arch of about 180 feet with a vaulted middle point that presents its back to the force of the river’s flow”—which Mende designed to endure the seasonal floods and ice-flows that decimated its wooden predecessor.⁷⁸ Composed of multiple “underwater arches,” the edifice concentrated and redirected the flow of the Mulde into a narrow channel, where Forster traced an elaborate distribution of “mechanical forces”: the sluice at the fore of the canal, which moderated the water’s flow; a waterwheel, “20 feet in diameter,” which “set eight pumps in motion” and drew water to power yet more engines of Mende’s design; and the

continuous drive of the stamp mill, powered by a second waterwheel, which crushed the ore extracted from the slope above.

The Gersdorf weir was built to withstand a time of contingency, designed in March 1779 as a “fortress, perpetually assailed by floods and water and ice.”⁷⁹ The fortress was flanked by “bulwarks” (*Schützwerke*) or “ice-catchers” (*Eißkästen*), as Mende called them, meant to maintain the integrity of the Mulde’s banks. Forster traced their peculiar shape in his diary (Figure 7): “On both sides of the arch gneiss walls run downstream,” he observed, “which draw back roundly, and are once again curved outwards, in order to mitigate the maelstrom of water.”⁸⁰ Indeed, Mende admitted to the Saxon Administration that he dare not estimate the cost of the project, “for in hydraulic engineering on rivers one must always expect that an unexpected flood will destroy in a day what can hardly be built in a month.”⁸¹ Also in March 1779, Mende outlined a broad program of architectural reform that would address both the timber shortage and the threat of diluvial ruin, securing the “*Dauerhaftigkeit*” of the Mining State as a whole. He argued that by “generalizing stonemasonry” in mineshafts, the state could ensure both the “protection of our forests” and the “everlasting endurance” of its hydraulic systems.⁸² To this end, he invoked the restorationist model of Roman architecture, citing the extant walls and aqueducts of ancient Carthage, the seat of a Phoenician empire sacked and rebuilt by the Romans in 146 B.C. Mende drew concrete lessons from “the remains of the ancient, famous city of Carthage,” adopting the Roman use of “thin lead sheets” as binding between hewn blocks. But the reference also served, like the Old Father’s Aqueduct, as an act of what Julia Hell calls “neo-Roman mimesis,” investing Mende’s new mechanics with ancient authority.⁸³

Mende’s authority, like his Saxon Carthage, was never certain, however, and “feudal hydraulics” of the sort were assailed on multiple fronts around the time of the French Revolution.⁸⁴ Forster had described Mende’s “masterpieces” in much the same tone as the chroniclers who generally reinforced the old environmental regime. He did not, for instance, mention how the flood of 1784 so severely inundated Gersdorf’s pits that new hydraulic technologies would again be required to make their depths workable.⁸⁵ By the close of the century, Mende’s “excessive constructions” were scrutinized precisely for their *lack* of frugal industry. An article titled “Pride and Project-Addition” described Mende as one who “loved neither true order nor frugality nor œconomy, in his private life as in his professional duties.” The “ship hoist” he designed to ferry ore between canals of different planes, installed in Halsbrücke in 1788, seemed to this critic a monument to its maker’s “arrogance.”⁸⁶ Just then revolutions began to spread across the France and the Austrian Netherlands, ultimately spilling across the Rhine to Forster’s new home of Mainz. There, he too began to voice a new politics of fluid energy.

Masters of the Flow

“All the wheels and engines of the old forms have ceased to operate,” Forster wrote his wife, Therese Heyne, from the Imperial City of Mainz in July 1791: “The ignorant nobleman must yield to the better, still more noble middle-class. For he lacks the *Energie* to sustain its usurpation.”⁸⁷ The problem of defunct wheels and engines beset by an irregular water supply, so clearly

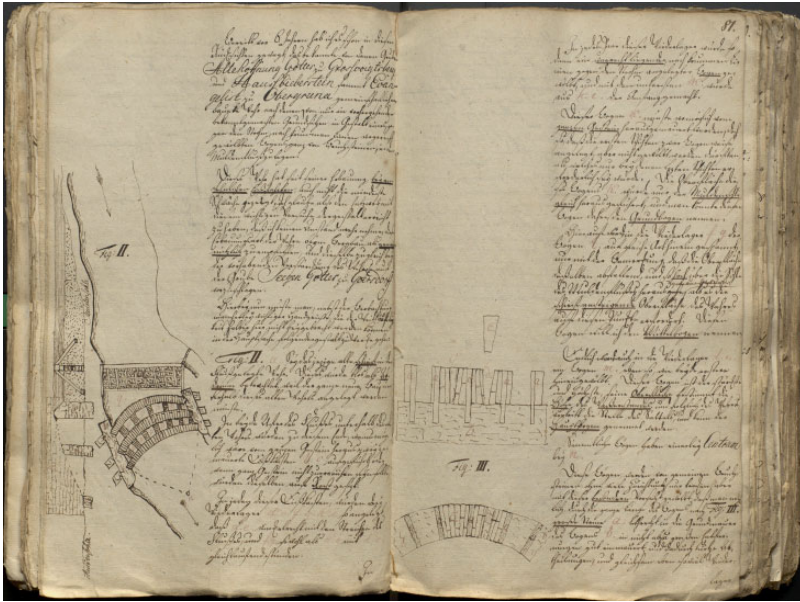


Figure 6. Mende's Gersdorf plan of 1779 showing the defunct wooden weir above three arches. Sächsisches Bergarchiv 40174, Grubenakten Freiberg Nr. 643, 81.

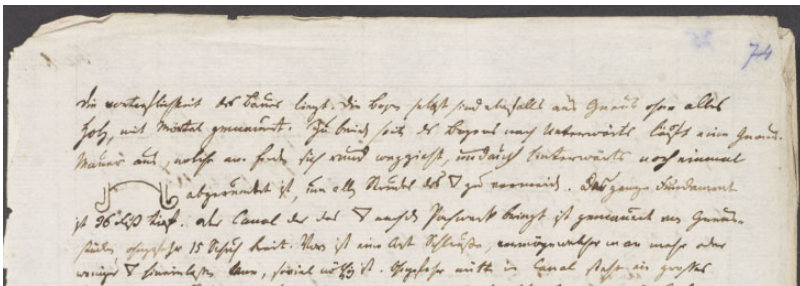


Figure 7. A sketch on the left margin of Forster's journal, showing the weir's riverside "bulwarks." Goethe- und Schiller-Archiv, Klassik Stiftung Weimar, 16/3, 74.

exhibited in the Mulde Basin, furnished Forster with an image of social upheaval. But as we've seen, the capacity to sustain energy flows and regulate hydro-climatic extremes was materially linked to the sovereignty of eighteenth-century states: hydraulic power was political power. Mende's very career, amid environmental and economic crises in Saxony, embodied this relationship. So, too, the iconography of Forster's bourgeois advocacy around the time of the French Revolution—and above all, the recurrent theme of hydrologic mastery—signified social contest over the management of waterways and forests. "The flow," as Andreas Malm has described the natural fluctuation of wind and

water systems on which the pre-industrial economy relied, grew increasingly volatile amid the climatic extremes of the 1780s, as El Niño events exerted climatic stresses on Europe until at least 1794.⁸⁸ At the same time, proponents of economic liberalization argued that “feudal hydraulics” had constrained Europe’s rivers and damaged its climate, a claim that mirrored the early revolutionary critique of the old regime’s timber-devouring iron industries.⁸⁹ “Land drainage, the fate of marshland, canal designs and the use of pumps to drive irrigation canals as well as mills, became key issues in the Revolutionary struggle,” Simon Schaffer wrote.⁹⁰ While French advocates identified new steam-powered technologies as the “liberators” of weary rivers, Forster’s idea was rather to reinvest old regime arts of endurance with the values of the liberal bourgeoisie.

The figure of Mende, representing a new class of technicians, loomed large in Forster’s advocacy for a new political class, captained by masters of fluid environments and economies. Only after Forster’s apprenticeship on the Mulde did he return to the figure of James Cook, a maritime analog to the Saxon mechanic, with whom he traveled a decade earlier. In a “monument” to Cook published in 1787, Forster sketched a stadial history that likened the development of civil society to the task of a savvy mariner, or indeed a skilled mechanic, contending with the unruly aqueous element. As the climatic challenges of the “raw zones” inspired art and industry, human passions did themselves swell into a “whirlpool” (*Wirbel*, such as he had seen in the Pacific) whose chaos “seized and swept away” rival factions. But amid the “surging currents in the ocean of humanity,” the polity was contrived as a delicate engine. “Legislation and civil constitution arose here as fragile, artificial machines,” Forster wrote, which powered “higher *Kultur*” the “faster and more forceful their wheels turned.”⁹¹ Maintaining mechanical order amid the “maelstroms” and “whirlpools” was as much a political feat in Forster’s imaginary as in the reality of early modern governance.

The age of revolution invested new meaning in the fluid mastery Mende represented. Forster’s call to re-engineer the “old forms” had already gained traction in the imaginary and institutional landscape of Revolutionary France. Also in 1791, Constantin-François Volney published his fantastical communion with ruins, *Les ruines, ou Méditations sur les révolutions des Empires*, which Forster translated to German in 1792. Volney had traveled through Egypt and Syria around the time Forster toured Saxony, chronicling the famine that followed insufficient flooding in the Nile Delta much as Forster observed the aftermath of the Elbe’s highwater.⁹² Like Mende, Volney sought artifacts of “public utility” in ruins, particularly in the hydraulic feats of antiquity: the dams of the Euphrates, the subterranean conduits of Medea, the aqueducts of Palmyra.⁹³ But as a deputy of the revolutionary National Assembly of 1789, Volney also identified the vanity and decay of ancient empires with that of the ancient régime, likening Versailles to the “useless” pyramids of Giza. By reverse engineering the pyramids, Volney invited readers to imagine how, by implication, a new French regime might repurpose old regime resources:

I have on various occasions calculated what might have been done with the resources wasted on the three pyramids of Giza, and I found that it could have easily constructed a canal from the Red Sea to Alexandria 150 feet deep and 30 feet wide, framed entirely with square-hewn stone and parapets, together

with a fortified commercial city of four hundred houses, adorned with draw wells. What an entirely different effect such a canal would have as compared to the pyramids!⁹⁴

That Volney, a scholar and a count, played the part of fluid master also signals the new esteem accorded to engineers in what Ken Alder describes as France's "democratic technocracy." The values of public utility that Forster and Volney associated with (hydraulic) engineering were institutionalized in French mechanical training, as engineers themselves became emblematic of a political order in which social hierarchy should accord with national service.⁹⁵

In this way, terrestrial enlightenment recognized that technical mediations of earth, water, and air materialized political orders. In 1790, Forster traveled down the Rhine with the young Alexander von Humboldt, who would become the era's most famous advocate of the correlation between deforestation and climate change.⁹⁶ Their object in 1790 was not unrelated: observing revolutions in the Austrian Netherlands and France, they sought artifacts and artificers to represent new forms of terrestrial habitation. This artifactual sense of politics was itself a subject of Forster's travel narrative, *Views of the Lower Rhine* (published 1791–94). New political constitutions, Forster argued in Aachen, must not be made "according to ideals abstracted from philosophical compendia" but suited to material conditions: "What is practically applicable must be made from coarser stuff, more material if you like, and therefore more natural and more human." A major commercial center of the seventeenth century, the Imperial City of Aachen now appeared to Forster to be the ruinous result of "guild coercion" and "artisanal despotism," its trade "diverted to distant canals" by competitive markets in the neighboring Netherlands. Mende's Waterpower Economy corresponded here to what Forster called the Human Economy, "violent extremes" of which caused a "dangerous stoppage in the great gears of Mankind." The threat of tyranny and anarchy, like that of drought and deluge, required a new agent akin to the "instructed individual" he'd envisaged a decade earlier. This "specially trained man" spoke "the voice of moderation." For an assembly of citizens formed "in the spirit of moderation" would be a "bulwark of civil liberty." As a page torn from his diary in Gersdorf shows, Forster claimed this bulwark would ensure "a moderate degree of civil as well as moral liberty through a well-proportioned distribution of forces and an artificial balance among different parts of the state."⁹⁷

Forster found "coarser stuff" in the manufacturing arts of Vaals in the Dutch Republic, several kilometers west of Aachen. Whereas guild restrictions and the repression of Protestants stifled the woolen industry within Aachen's city walls, the comparative religious liberty and general physiocratic land tax in Vaals appeared to Forster to be the archetype of a free commercial society. Forster's apprenticeship in the Mulde Basin prepared him well to inspect the sprawling textile complex there, which was owned by Johann Arnold von Clermont, a liberal aristocrat who served as a member of the provisional government for French-occupied Aachen in 1794–95. Here Forster described an intricate distribution of fluid energy, from the waulking mill, where imported wool was washed and prepared, to the aqueduct that supplied dyeing baths and boilers in several chambers throughout the large factory. Observing how the coppers were filled

and emptied by the turn of a lever, he studied the economic art by which wool workers repurposed “excess water” through subsurface piping.

According to Forster’s polemic, the factory’s fluid economy also propelled a distribution of intellectual energy. Here was a liberal re-invention of the paternalist order Deurer championed in Palatine disaster relief. In the place of Elector Karl Theodor was the industrialist Clermont, from whom Forster abstracted the enlightened “*Privatmann*, manufacturer of a free state,” likewise seen as guarantor of the people’s well-being. While “the despot trembles before the enlightenment of his subjects,” Forster wrote, the “*Privatmann* . . . derives his own prosperity from that of his fellow citizens, and from the realization of their intelligence!”⁹⁸ However vague Forster’s equation between linen production and popular enlightenment, the polemic was meant to materialize an oppositional politics theorized around 1790 by liberals like Alexander’s elder brother Wilhelm von Humboldt, who sought to replace the state paternalism with humanistic ideals of *Bildung*.⁹⁹

Views of the Lower Rhine, a study of disaster and durability updated for the age of revolution, was in many ways the travel narrative Forster *didn’t* publish in 1784. Scenes of ruin abounded in Belgium, then in revolt against Hapsburg rule. Belgium’s troubles with Austria went back at least to 1784 when Joseph II issued a set of liberal reforms designed to curtail the vested clerical and guild authorities in territories the Hapsburgs held since the War of Spanish Succession in 1714. Forster sympathized with the Belgian Estates’ “patriotic” hostility to a foreign monarch, but not more than he supported Joseph’s secular reforms.¹⁰⁰ The “ruins of the extensive bastion in Tournai,” a Bastille-like function of the Brabant Revolution, thus appeared to him like the ruin nature brought upon “works of men” in Halsbrücke:

If we rejoice in finally discarding these unnatural monuments to the debauched passions of our barbaric forefathers, rendering them useless, we should at least find compensation in the beautiful spectacle of hard work and diligent industry, which is vouchsafed by the sight of all great works carried out by the hand of man. Leave us the old bastions and bulwarks rather than these barren heaps of rubble. . . .¹⁰¹

The passage’s likeness to the diary of 1784 illustrates the duality of disaster as both a natural and political phenomenon. Revolutions “are fast and fierce convulsions from the ground up, in nature as among men,” Forster mused.¹⁰² Echoes of the Halsbrücke collapse, which left “not a single trace” of human labor, also show the persistence of the problem of *Dauer*. “When the dream of life has vanished,” Volney began *Les ruines*, “what use will its tremors have been if they leave behind not a trace of their utility!”¹⁰³ The revolutionary age required arts of endurance.

Belgium provided these arts in equal abundance, particularly in Flanders, where Forster found a “freer Constitution” and more equitable allocation of parliamentary votes than among their Brabant neighbors.¹⁰⁴ This corresponded to the reclamation and canalization projects that characterized Flanders’ own “built nature.” The Flemish coast witnessed “fell catastrophes” in the form of “extraordinary floods.” In the dunes near Dunkirk, “a church tower stood buried in the sand and only its spire still protrudes.”¹⁰⁵ As in 1784, however, scenes of

diluvial wreckage made Flemish arts of endurance still more noteworthy to the traveler. Forster and Humboldt finally traveled by “bark” to Antwerp, the commercial hub on the estuary of the Scheldt. As they departed the city for the North Sea, its Gothic cathedrals and prominent citadel began to appear, a half-mile behind them, like a “forest of towers.” With yet more distance, white sails of fluid commerce came into view on the Scheldt, and Forster remarked upon twenty-foot tides tempered by steadfast city walls. The vignette gave terrestrial enlightenment a history, from forest dwellers to fluid economy. In fact, when the Scheldt and its tributaries flooded in February 1784, causing devastation upstream, Antwerp reported neither damage nor casualties—thanks, one newspaper reported, “to the ebb and flow” of the estuary.¹⁰⁶ “We beheld its humbled waters,” Forster wrote, “and we drew a new breath of European politics and the law of European nations.”¹⁰⁷ In drawing that breath, Forster rhapsodized what events in France had already realized: revolution was as much a climatic event as natural disaster was political.

State of Precarity

Forster’s view of the Scheldt, “humbled” and free flowing, made a stark contrast with the hydrosocial scenery on the Seine in Paris on the eve of revolution. In a painting by Robert Hubert (now lost), the Seine appeared frozen beneath a stormy sky. Captured in the uncommonly harsh and snowy winter of 1788/89, the scene recalled the catastrophic hailstorms that decimated large swaths of the country’s wheat crop earlier that year. Moreover, as Nina Dubin observes, the ice-locked waters of Paris’s main commercial concourse also signaled the economic stagnation associated with monarchy’s fiscal deficit.¹⁰⁸ By the time the painting was exhibited in 1789, the destruction wrought by those storms, compounded by the fiscal crisis, led to food shortages, bread riots, and revolution. In the “climate of economic dread” that preceded the political rupture of 1789, Hubert, like Volney, depicted ruinous cityscapes—from Roman aqueducts to razed cathedrals—as a medium of “acculturation” to an apparent caesura in history, a dramatic break from the continuity of the past. The aesthetics of ruin was closely linked to that of catastrophe, as the Revolution itself was sometimes depicted as a natural disaster. From the frozen Seine, Hubert turned to the Storming of the Bastille in 1789, evoking his earlier rendering of Vesuvius with an “infernal glow” about the bastion’s demolition.¹⁰⁹ Naturalizing revolution might condemn or condone its violence, as Mary Ashburn Miller has argued. Metaphors of tremors, eruptions, and floods apparently removed human agency from the most radical and deadly period of the Revolution: the Terror of 1793/94.¹¹⁰

But as Hubert’s lost Seine suggests, naturalistic depictions of socio-economic events were not only metaphorical. Acculturation through “catastrophism” was also a practice of *acclimatization*, as contemporaries became sensitive to the intricate relationship between regime change and climate change. Hydro-climatic imagery, in particular, acknowledged the environmental forces acting on, and through, the Revolution, from the erratic precipitation of the late 1780s to the climatic fallout of forest de-regulation in the Revolutionary state. That state was understood by many, including Forster, as a state of (climate) precarity.

The system of political artifice Forster envisaged in 1790, with its moderating bulwarks and well-proportioned forces, was truly the inverse reflection of the environmental extremes that characterized the revolutionary age. As Elbe's highwater marks were battered again in 1785, drought in France led to severe losses of livestock, while the return of a long winter and wet spring in 1787–88 caused de-regulated grain prices to increase by roughly 50 percent.¹¹¹ The ensuing winter was reminiscent of 1784 with deep cold punctuated by sudden thaws. From Mainz in January 1789, Forster warned a correspondent downstream in Dusseldorf about the likelihood of a "nasty visit" from "Father Rhine." The severe cold sent quake-like tremors through the ground, Forster wrote, as the frozen Rhine portended terrific ice-flows: "Here the people who live along the river are already clearing the ground floors of their homes." Still, he found it hard to fathom another event quite like "the year 1784."¹¹² In Paris, meanwhile, Thomas Jefferson recorded cold "without example in the memory of man." As his Fahrenheit thermometer plunged to 50° below freezing, Jefferson observed a Bourbon regime "driven to the last ditch by the universal call for liberty" feebly attempt to procure enough firewood to keep its subjects from freezing—or revolting.¹¹³

Arguably, the French Revolution began as an upheaval against the old environmental order. The early months of 1789 saw mass rebellion against hunting laws and restricted access to common forest resources that were privileges of the aristocracy. Popular hostility toward wood-fueled industries also garnered support for the revolution, which initially promised to reduce the strain that the Bourbon "war-state" long exerted on French forests.¹¹⁴ Indeed, state forestry was closely identified with the "climate of economic dread" that hung over France in the 1780s, since it not only used timber to fuel arms production but also sold wood to attempt to pay off the enormous debts incurred by war finance. Debt, like denudation, threatened to "deluge the kingdom with paper" currency, as the public credit crisis was frequently reported in the late 1780s.¹¹⁵

The new environmental order was riven with many of the same conflicts as the old. The crop failures and fuel scarcity that galvanized popular support for the National Assembly in 1789 also wrought considerable tension within the young Republic, proclaimed on September 21, 1792. In the winter of 1792–93, food shortages were compounded by inflation, war requisitions, and mass conscription, which fueled radical politics in Paris. In February, the *sans-coulottes* organized attacks on grain merchants, demanded the regulation of the free trade market, and called for the heads of the small-farming "hoarders" whom they accused of spiking cereal prices. Nevertheless, the Jacobin-led Assembly doubled down on its free trade principles, such as de-regulating the water and forest jurisdiction that it saw as traditional symbols of absolutism and seigniorial privilege.¹¹⁶

Far from resolving the regulatory crisis of the late eighteenth century, revolution unleashed a greater scale of exploitation in the name of economic liberalism. A 1791 law enabled the sale of state lands and curtailed the authority royal foresters once held over private landowners, whose hands were strengthened again through legislation of 1793 that privatized common lands and forests.¹¹⁷ At the same time, the outbreak of war in 1792, and the demand it placed on iron foundries, allowed the *Corps des Mines* to seize forests in the name of the national destiny. This presaged the enormous energy demands of the imperial

war-state of the Napoleonic era. The ensuing deforestation triggered familiar desiccationist alarms and raised the specter not only of wood shortages, this time, but of the atmospheric impact of denudation. Agriculturalists and engineers, most notably *Ponts et chaussées* chief François-Antoine Rauch, decried the new forest policy as a violent disruption to the harmony between “hydro-vegetal” and meteorological systems, as though describing a breach of Forster’s natural contract.¹¹⁸ Practically speaking, the conservation movement argued that deforestation would rapidly dehumidify and unsettle the soil, possibly exposing riverside populations to unprecedented erosion and increased flooding. As Noelle Plack observes, Assembly speeches and government reports were rife with such concerns and described an “unmitigated environmental disaster in the countryside.”¹¹⁹ And yet many Assembly members, faced with provincial reports of environmental destruction, echoed old regime magistrates in blaming an ungovernable, thieving peasantry rather than the policy shift toward a market economy. Not only in image and metaphor, but also in this legislative and ecological sense, the French Republic had become a state of climate precarity.

Revolution was a *Naturscheinung*, Forster wrote, a natural phenomenon. Revolution, so seen, was a violent distortion of the long-standing relationship between political power and environmental stewardship. “Moderation is the virtue that our age lacks the most,” Forster lamented in Aachen as he devised an artifactual politics to temper socio-environmental extremes.¹²⁰ But by April 1793, he found “no virtue in revolution” and described its tumult to Therese Heyne as a “sin against humanity, against the holy Mother Earth.”¹²¹ Forster was sent to Paris at the end of March as a delegate of the fledgling Mainz Republic, established earlier that month under the auspices of the occupying French army. He arrived amid acute inflationary and ecological crisis as the French Republic faced war in and outside of its borders. In March, the Jacobins met violent dissent in Paris and counter-revolution in the Vendée with the Committee of General Security, holding the first session of the Revolutionary Tribunal, the judiciary power behind the Terror, on April 6. By the 15th, the mayor of Paris demanded that deputies of the moderate Girondin party be purged from government. The following day, Forster described to Heyne the “tyranny of Reason” that beset the city. She prompted him to write a chronicle of the revolution, which Forster said meant “rummaging through filthy subterranean canals.” “Conflagration and deluge, the noxious effects of fire and water,” Forster groaned, “are nothing compared to the calamity that Reason will soon cause,” at least not until there was “moderation in Reason’s application.” April 1793 also saw the theatre of the War of the First Alliance shift to Mainz, the first republic on German soil. By June, a coalition of German and Austrian batteries reduced the city to “rubble and wreckage,” as the poet Johann Wolfgang von Goethe described the scene of “smoking ruins” in the envoy of the Duke of Weimar.¹²²

Goethe shared the sense of revolution as a cataclysmic natural force.¹²³ Goethe had been a mining official in the Duchy of Weimar and received instruction from Trebra during his time in the Harz Mountains. He knew the terrible potential of “the flow,” especially as deep-rooted anxieties about timber-shortages were combined in the 1790s “with observations regarding flooding caused by the denudation of slopes.”¹²⁴ After the turn of the century, Goethe

described a memoir of the revolution by the Jacobin naturalist Jean-Louis Giraud Soulavie accordingly, as floodwaters careening down a slope:

Altogether it gives a monstrous prospect of brooks and streams, which of a natural necessity descend from many heights and many mountain valleys, rushing into a confluence that finally bursts the banks of a great river and produces an inundation that lays waste to him who foresaw just as it destroys him who suspected nothing.¹²⁵

Goethe learned to “always expect an unexpected flood” during his ill-fated attempt to revive silver mines in Weimar, which had been destroyed by floodwaters in 1739. On a rainy February 24, 1784, the day a deep cold spell broke into catastrophic flooding across Europe, Goethe addressed a crowd of notables in the shelter of the Ilmenau posthouse. He commemorated a newly opened shaft by “commit[ting] those already inundated mines forever to water and darkness.”¹²⁶ The naturalist Soulavie, meanwhile, made “*climât*” (sic.) a synthetic category of natural inquiry. His *Histoire naturelle de la France Méridionale* (1780–1784) established the altitudinal arrangement of horticulturally defined and barometrically determined climatic zones. “Alpine,” “chestnut,” and “vineyard” climates were portrayed on an idealized mountain slope to exhibit “the climates of the planet.”¹²⁷ Goethe read Soulavie’s memoir of revolution much as savants and mining experts looked at denuded slopes and flood plains: as a foreseeable yet inexorable hydro-climatic event.

When Forster undertook a chronicle of the Revolution, from his garret on the Rue des Moulins in the autumn and winter of 1793, he too returned to hydrosocial scenography. Renouncing moderation altogether, he now claimed “it would be madness to try to stop or contain” such a groundswell. In vain did those “swept up in this maelstrom attempt to regulate themselves according to Reason.”¹²⁸ So began the letters later published as the *Paris Profiles*, the first of which is dated “1st of the Winter Moon (Brumaire), 2nd Year of the Republic.” The republican calendar was itself an attempt to align the state with predictable celestial and atmospheric cycles, as if to “somehow shield the Revolution from storms and disasters.”¹²⁹

The month of Brumaire, for instance, was named for the fog typical in France in late October and early November. It was allegorized by the figure of a shepherdess returning from pasture, carrying a bundle of firewood as a cold wind gathers laden clouds (Figure 8). “It’s so cold that I can only warm myself in bed,” Forster had complained to Heyne already at the end of September (or Vendémiaire, named like Soulavie’s temperate zone for the grape harvest). “But one simply cannot heat oneself in a city where a cord of wood costs 130 livres,” he explained.¹³⁰ By the winter of 1793/94, the Jacobin dictatorship had executed much of its moderate opposition. Forster’s maelstrom changed with the season. Revolution became an “avalanche of snow, accelerating, gaining mass as it rushes, annihilating all that resists its path.” The recent decree of the Convention, to “remain revolutionary until peace,” simply recognized the inevitability of this “new, unstoppable movement.”¹³¹ The inundations and ice-flows chronicled in 1783–84 appeared again, a decade later, in political form.

Terrestrial enlightenment made out to moderate ruinous forces, human and natural. But the technical and political means by which it sought those ends



Figure 8. Allegory of Brumaire (after the French for fog or veil, *brume*), the second month of the autumn quarter. Louis Lafitte, *Calendrier républicain*, 1800. Paris, Bibliothèque Nationale. Wikimedia Commons.

sometimes wrought new extremes in the process. The *Privatmann* Forster entrusted to bring about a new liberal order of terrestrial habitation quickly supplanted the fiscal-military state as an even greater violence upon de-regulated woodlands and waterways, threatening climate disaster on a scale unseen in the old environmental order. Forster's *Profiles* therefore struck the posture of the hydraulic technician: if he could not see "Nature unchanging," he must at least

expect the unexpected. He assumed a privileged view of the violent course the Revolution must necessarily take, “until its motive force is completely exhausted.” Forster did not weather “the Storm,” however, as he called the Revolution by December 1793. He fell ill on the night of 20 December after walking across the city unable to find a coach.¹³² “I am not worried about the illness,” Forster wrote to Heyne, “only frightened that the season and the cold, damp winter weather will make me miserable and cripple me into the new year.”¹³³ He died on January 10, or 22 *Nivôse*, from the Latin for “snowy.”

Anthropocene, a Time to Wrangle

Of the public debt crisis that beset the Bourbon monarchy—a looming “deluge,” it was said—Michael Sonenscher observes that “the imminence of disaster could be seen as an opportunity to establish a regime that could face the possibility of Armageddon in a way that no actually existing system of government might be able to do.”¹³⁴ Environmental disasters functioned similarly. This article has shown some of the ways in which climate became constitutive of late-eighteenth-century politics, especially in the interrelated realms of hydrology and forestry. If the deluge of 1784 spurred some chroniclers to reinforce the “bulwarks” of the old environmental order, others began to ponder new forms of earth-oriented politics. To the poet Cowper, climate precarity signaled the “need of social intercourse”:

Benevolence and peace and mutual aid
Between the nations, in a world that seems
To toll the death-bell of its own decease,
And by the voice of all its elements
To preach the gen’ral doom.¹³⁵

The chroniclers of 1784 saw environmental ruin as a social question, much as fluid masters like Mende saw drought and deluge as threats to the *Dauerhaftigkeit* of the state itself. In a lyrical iteration of Latour’s “terrestrial question,” Cowper asked:

Is it a time to wrangle, when the props
And pillars of our planet seem to fail,
And Nature with a dim and sickly eye
To wait the close of all?

Our own age of dual crisis has inspired a similar stance among humanists who theorize the Anthropocene concept as the basis of a planetary solidarity. In Dipesh Chakrabarty’s powerful formulation, Anthropocene suggests a new universal grounded in our collective capacity to affect, and be affected by, the global climate.¹³⁶

Understanding how people answered the “terrestrial question” around 1800 may explain why it remains so prescient today, in a world whose “death-bell” rings louder with each record-breaking drought, flood, or temperature extreme. Certainly, European states responded to the dual crisis of the late eighteenth century with increased attention to resource management and disaster mitigation. In France, Restoration politics condemned the liberalization of forests as

the cause of progressive climatic deterioration in the bourgeois order. The indictment served to reinvest authority in state forestry programs, as mirrored in exclusionary forest codes across the Rhine.¹³⁷ German states met the threat of flood with the same heavy hand. Emblematic of the era's audacious hydrological projects was the re-making of the Rhine, whose flood plains engineers fixed in a single, more navigable, and less flood-prone riverbed. But projects of the sort came at an enormous cost to riverside populations and wetland biodiversity. If "correcting" rivers made floods less frequent, it also made them more violent.¹³⁸ Forestry measures, too, traded one form of disaster for another. Revamped forest administrations in western and central Europe now dealt explicitly with the hydro-climatic effects of deforestation.¹³⁹ But popular access to timber did indeed contribute to the "general revolution" that spread across the Continent in 1848-49, especially in the Rhineland.¹⁴⁰

Forster's answer to the terrestrial question in 1790 presaged another characteristic feature of European climate politics. To him, the prospect of a "denuded and uninhabitable" Europe implied both new forms of political organization and new forms of planetary domination. The climate refugees he imagined fleeing the "hunger and cold" of Europe were also colonial aggressors, poised to "flow in great heaps across the barbaric parts of the world" and "conquer or expel" the inhabitants of Asia, Africa, and the Middle East. "We will surge into the forests of Haemus, of Taurus and Amanas, even into the Caucasus and Emmaus," Forster frothed in his imperial fantasy, ranging from the Mediterranean to Central Asia, "and bear the torch of science back to those regions whence it was first came."¹⁴¹ Like the canal Volney repurposed from pyramids, the passage shows how restorationist programs implemented in Europe's floodplains were redeployed in aggressive colonial schemes, supposedly justified by environmental reclamation.¹⁴² In this sense, too, Forster's Rhineland forecast was horrifically accurate, portending global systems of resource plunder. The legacy of terrestrial enlightenment is the ruin in which we live.

Endnotes

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16. Georg Forster, *Ansichten vom Niederrhein, von Brabant, Flandern, Holland, England und Frankreich, im April, Mai und Junius 1790*, 3 vols. (Berlin, 1791–94), vol. 1, 315–320.
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18. Radkau, *Nature and Power*, 204, 139; Richard Hölzl, *Umkämpfte Wälder: Die Geschichte einer ökologischen Reform in Deutschland, 1760-1860* (Frankfurt, 2010), 68–104; Paul Warde, *The Invention of Sustainability: Nature and Destiny, c. 1500-1870* (Cambridge, UK, 2018), 145.
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22. Sonenscher, *Before the Deluge*, 66–67.
23. E.g., Alan Mikhail, “An Irrigated Empire: The View from Ottoman Fayyum,” *International Journal of Middle Eastern Studies* 42 (2010): 569–590; Vera S. Candiani, *Dreaming of Dry Land: Environmental Transformation in Colonial Mexico City* (Stanford, 2014); Eric H. Ash, *The Draining of the Fens: Projectors, Popular Politics and State Building in Early Modern England* (Baltimore, 2017).
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29. Huet, *Culture of Disaster*, 8–9.
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31. Georg Forster, *Tagebuch*, April 24, 1784, AA, XII, 21–22; Forster to Samuel Thomas Sömmering, April 24, 1784, AA XIV, 46.
32. Forster, April 24, 1784, AA XII, 22.
33. Forster to Sömmering, April 24, 1784, AA XIV, 47.
34. Forster, April 30, 1784, AA XII, 27.
35. Forster, "Blick in das Ganze," 95–96.
36. Forster, June 30, 1784, AA XII, 53.
37. Demarée, "Catastrophic Floods," 890.
38. Alexander von Humboldt, ed., *Allgemeiner Hydrographischer Atlas. Eine Sammlung von Sechzehn Karten... von Dr. Heinrich Berghaus* (Gotha, 1850), 2te Abtheilung: Hydrographie No. 15.
39. Christian Gottlieb Pötzsch, *Chronologische Geschichte der großen Wasserfluthen des Elbstroms seit tausend und mehr Jahren* (Dresden, 1784), 139–40; anon., *Getreue Beschreibung*, 39–40.
40. Pötzsch, *Nachtrag und Fortsetzung seiner Chronologischen Geschichte...* (Dresden: Walther, 1786), Tabellarische Vorstellung, 1501–1784; Christian Rohr and Guido N. Poliwooda, "Aus Katastrophen lernen. Sachsen im Kampf gegen die Fluten 1784 bis 1845," *Historische Literatur* 5, no. 4 (2007): 189–191.
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von den dadurch angerichteten traurigen Verwüstungen welche in den Monaten Februar und März dieses 1784sten Jahres fast in ganz Deutschland sich erüugnet haben (Lauban, 1784).

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49. Blackbourn, *Conquest of Nature*, 3, 45.

50. *Allgemeine Literatur-Zeitung*, Bd. 3, No. 152 (1785): 31–32.

51. Deurer, *Umständliche Beschreibung*, 217–20.

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57. Forster, “Blick in das Ganze,” 96.

58. Julia Hell, *The Conquest of Ruins: The Third Reich and the Fall of Rome* (Chicago, 2019), 3.

59. Forster, July 14, 1784, AA XII, 82–83.

60. Ludewig Wilhelm Gilberts *Handbuch für Reisende durch Deutschland*, Pt. 2 (Leipzig, 1792), 648. Cf. Friedrich Gottlob Leonhardi, *Handbuch für Reisende durch Sächsische Länder* (Leipzig, 1796), 380, in which the “Roman *Aquaeductus*” is still in operation. A popular engraving of the aqueduct appeared in Ludwig Richter and Carl August Richter, *70 Mahlerischen An- und Aussichten der Umgegend von Dresden in einem Kreise von sechs bis acht Meilen* (Dresden, 1822), Plate 49.
61. Dubin, *Futures and Ruins*, 2.
62. Forster, July 14, 1784, AA XII, 83.
63. See the indictments voiced by Rousseau, Voltaire, and others in Huet, *Culture of Disaster*, 51–55.
64. Forster, July 14, 1784, AA XII, 83.
65. Sächsisches Bergarchiv (hereafter SächsBergAFG) 40089, Nr. 94, 102–134.
66. Hans Baumgärtel, *Bergbau und Absolutismus: Der sächsische Bergbau in der zweiten Hälfte des 18. Jahrhunderts und Maßnahmen zu seiner Verbesserung nach dem Siebenjährigen Krieg* (Leipzig, 1963).
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68. Heinrich von Trebra, *Merkwürdigkeiten der tiefen Hauptstölln des Bergamtsreviers Freyberg* (Dresden, 1804), 74–75, 82. Cf. Heinrich von Trebra, *Bergmeister-Leben und Wirken in Marienberg: vom 1. Decbr. 1767 bis August 1779* (Freyberg, 1818), 76–77.
69. Mikhail, “Irrigated Empire,” 570, 579; Alan Mikhail, *Nature and Empire in Ottoman Egypt: An Environmental History* (Cambridge, UK, 2011), 47, nt. 22.
70. See historiographical discussion in Radkau, *Nature and Power*, 124–25; Jan de Vries, *The Dutch Rural Economy in the Golden Age, 1500-1700* (New Haven, 1974), 197.
71. Josef Konvitz, *Cartography in France: Science, Engineering and Statecraft* (Chicago, 1987), 105–111.
72. Radkau, *Nature and Power*, 199; Blackbourn, *Conquest of Nature*, 39–45.
73. *Ibid.*, 52.
74. Radkau, *Nature and Power*, 204.
75. The file SächsBergAFG 40089, Nr. 94 is labeled “Den Wasser-Streit des bergbaues mit dem Freiburger Stadt-Rathe wegen der Münzbach und Mulden Wasser nebst Hütten und Neuen Teich betreffend.” It begins with a history of conflict over water resources since 1650. Mende’s essay “Ueber die Ersparniss der Aufschlagswasser” (97) is followed by plans for a water-saving pump (102–134) and another lecture on the topic (158).
76. E.g., January, 19 1747, SächsBergAFG, 40001, Oberbergamt Freiberg, Nr. 3685, 71.
77. Otfried Wagenbreth and Eberhard Wächtler, *Der Freiburger Bergbau: Technische Denkmale und Geschichte* (Leipzig, 1986), 62–72.
78. Forster, 9 July 1784, AA XII, 73.

79. “Vorschläge wie das zur Grube *Seegen Gottes* zu *Goersdorff* gehörige, im Muldenfluße liegende, schadhaft gewordene Pochwerkswehr auf immer in Sicherheit zu sezen sey” (March 31, 1779), *SächsBergAFG* 40174, *Grubenakten Freiberg* 643, 73–83, at 78.

80. Forster, July 9, 1784, AA XII, 73.

81. *SächsBergAFG* 40174, *Grubenakten Freiberg*, Nr. 643, 83.

82. “Ueber die Grubenmauerung” (March 13, 1779), *SächsBergAFG*, 40010, Nr. 3245, 65–70, at 63, 67, later published in *Neues Bergmännisches Journal*, Bd. 11 (1794): 323–349, on 339–340.

83. Hell, *Conquest of Ruins*, 187–88, 228–29. In modern Europe, and not least in Forster’s own travel writings, the Roman re-construction of Carthage concretized a powerful colonial mythology by which Europeans claimed architectural superiority over “oriental” and societies.

84. Simon Schaffer, “*Empire as Far as the Skies: Hydraulics, Heat and Climate in Restoration France*,” forthcoming.

85. Wagenbreth and Wächtler, *Freiberger Bergbau*, 247.

86. “Warnung vor Stolz und Projektsucht,” *Nationalzeitung der Teutschen*, 2tes Stück (Gotha, January 10, 1799), *SächsBergAFG* 40133-1, Nr. 1563, 59–60.

87. Forster to Therese Heyne, July 25, 1791, in *Georg Forster’s Briefwechsel*, ed. Therese Huber, née Heyne, vol. 2 (Leipzig, 1829), 82.

88. Malm, *Fossil Capital*, 38–39; Grove, “The Great El Niño of 1789–93,” 86–92; Grove, “The ‘Great El Niño’, 1790–1794,” 82.

89. Bonneuil and Fressoz, *Shock of the Anthropocene*, 182, 201, 255; Radkau, *Nature and Power*, 203; Jean-Baptiste Fressoz & Fabien Locher, *Les révoltes du ciel: une histoire du changement climatique XVe—XXe siècle* (Paris, 2020), 80–81.

90. Schaffer, “*Empire as Far as the Skies*.”

91. Georg Forster, “Cook der Entdecker,” in AA V, 60–172, at 65. For a more extensive interpretation of Forster’s Cook as an “administrator, not an explorer,” see Michael Dettelbach, “Romanticism and Administration: Mining, Galvanism and Oversight in Alexander von Humboldt’s Global Physics” (PhD diss., University of Cambridge, 1992), 4–6.

92. Damodaran et al., “The 1780s,” 20–22. Volney would later link the weather events of the so-called “Year Without a Summer” (1816) to volcanic activity, drawing on the memory of 1783/84. See Constantin-François Volney, “Au rédacteur du *Mercure*, 14 décembre 1817,” *Mercure de France*, t. 5 (Janvier 1818): 111–17.

93. Constantin-François Volney, Député à l’Assemblée Nationale de 1789, *Les ruines, ou Méditations sur les révolutions des Empires* (Paris, 1791), 60–61, 70–71; idem., *Die Ruinen*, trans. Georg Forster (Berlin, 1792), 53, 61–62. On Volney’s ruin gaze, see Susan Stewart, *The Ruins Lesson: Meaning and Material in Western Culture* (Chicago, 2020), 215–17. Cf. Mende, *Neues Bergmännisches Journal* 11 (1794), 339.

94. Volney, *Les ruines*, 343; *Die Ruinen*, Noten 13. The colonial fantasy of re-engineering Giza would reappear in the writings of industrial reformers in Restoration France. See Simon Schaffer, “Oriental Metrology and the Politics of Antiquity in Nineteenth-Century Survey Sciences,” *Science in Context* 30, no. 2 (2017): 173–212, at 179–80.

95. Ken Alder, *Engineering the Revolution* (Chicago, 1997), esp. 292–96, 303–07.
96. Grove, *Green Imperialism*, 366–68.
97. Forster, *Ansichten*, vol. 1, 259, 265–66, 268, 273, 281–83, emphasis his. Another noteworthy resource for the “mittleren Grad” of liberty is the *Mittelmaas* that “Nature seems to have prescribed in all things.” So Forster described a blast furnace of “moderate size” in Halsbrücke, designed to economize scarce wood fuel: “if we do not go to a certain point, the force we apply will not be proportionate to that which we seek to overcome; but if we go beyond this point, the advantage will not be so great as we had expected, having wasted that force.” (Forster, July 14, 1784, in AA XII, 84.)
98. Forster, *Ansichten*, vol. 1, 307–309.
99. Hans Frambach, “The Decline of Cameralism in Germany at the Turn of the Nineteenth Century,” in *Cameralism in Practice: State Administration and Economy in Early Modern Europe*, eds. Marten Seppel and Keith Tribe, 239–61 (Woodbridge, UK, 2017), 247.
100. On Forster’s chronicle of revolution in Belgium, considers Thomas P. Saine, *Georg Forster* (New York, 1972), 116–23; Ludwig Uhlig, *Georg Forster: Lebensabenteuer eines gelehrten Weltbürgers* (Göttingen, 2004), 269–70; Jürgen Goldstein, *Georg Forster: Zwischen Freiheit und Naturgewalt* (Berlin, 2015), 151–67.
101. Forster, *Ansichten*, vol. 2, 205–206.
102. *Ibid.*, 490.
103. Volney, *Les ruines*, xv–xvi; *idem.*, *Die Ruinen*, 5.
104. Forster, *Ansichten*, vol. 2, 275–78.
105. *Ibid.*, 227–28.
106. As quoted in Demarée, “Catastrophic Floods,” 890.
107. *Ibid.*, 292–93.
108. Dubin, *Futures and Ruins*, 135.
109. *Ibid.*, 5, 136.
110. Miller, *Natural History of Revolution*, 13, 167.
111. Grove, “The Great El Niño of 1789–93,” 91; Sylvia Neely, *A Concise History of the French Revolution* (Plymouth, UK, 2008), 72–73.
112. Forster to Friedrich Heinrich Jacobi, January, 22 1789, in Therese Forster, ed. *Georg Forster’s sämtliche Schriften*, 9 vols. (Leipzig, 1843), vol. 8, 53; Forster to Therese Heyne, January 23, 1789, *ibid.*, 55–56.
113. As quoted in Kington, “Daily Weather Mapping from 1781,” 32.
114. Bonneuil and Fressoz, *Shock of the Anthropocene*, 255; Brosselin et al., “Les doléances contre l’industrie.”
115. Arthur Young, *Travels During the Years 1787, 1788, & 1789; Undertaken more Particularly with a View of Ascertaining the Cultivation, Wealth, Resources, and National Prosperity of the Kingdom of France*, vol. 1 (London, 1794), 623; Sonenscher, *Before the Deluge*, 1–2, 6, 66–67.

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118. Fressoz and Locher, "Modernity's Frail Climate," 584.
119. Noelle Plack, "Environmental Issues during the French Revolution: Peasants, Politics and Village Common Land," *Australian Journal of French Studies* 47, no. 3 (2010): 290–303, at 294; Noelle Plack, *Common Land, Wine and the French Revolution: Rural Society and Economy in Southern France, ca. 1789-1820* (Farnham, UK, 2009).
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121. Forster to Therese Heyne, April, 16 1793, *Im Anblick des großen Rades: Schriften zur Revolution*, ed. Ralph Rainer Wuthenow (Darmstadt, 1981), 192–93.
122. Johann Wolfgang von Goethe, "Belagerung von Mainz," *Goethes Sämmtliche Werke*, 10 vols, 333-360 (Stuttgart, 1885), 345–46.
123. Goldstein, *Georg Forster*, 194–204.
124. Warde, *Invention of Sustainability*, 326–27; Radkau, *Wood*, 167, 170.
125. Johann Wolfgang von Goethe to Friedrich Schiller, March 9, 1802, in *Goethes Werke. Herausgegeben im Auftrage der Großherzogin Sophie von Sachsen*, 133 vols. (Weimar, 1887–1919), Pt. 4, vol. 16, 49; Goldstein, *Georg Forster*, 200.
126. "Feierlichkeit bei Eröffnung des neuen Bergbaues zu Ilmenau, den 24. Februar 1784," Goethe- und Schiller-Archiv, Klassik Weimar, 25/W 2776.
127. M. l'Abbé Soulavie, *Histoire naturelle de la France Méridionale, Sonde partie, Les Végétaux* (Paris, 1783), 264.
128. Georg Forster, "Pariser Umriss," in *Im Anblick des großen Rades*, 131–84, at 134.
129. Huet, *Culture of Disaster*, 109–110.
130. Forster to Therese Heyne, September 25, 1793, *Briefwechsel*, 588; Forster to Heyne, September 30, 1793, *ibid.*, 592.
131. Forster, "Pariser Umriss," 133–34.
132. Forster to Heyne, December 20, 1793, *Briefwechsel*, 643–44.
133. Forster to Heyne, December 22, 1793, *ibid.*, 647.
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135. Cowper, *The Task*.
136. Dipesh Chakrabarty, "The Climate of History: Four Theses," *Critical Inquiry* 35 (2009): 192–222; *idem.*, "Human Agency in the Anthropocene," *Perspectives on History* 50 (December 2012); *idem.*, *The Climate of History in a Planetary Age* (Chicago, 2021).
137. Fressoz and Locher, "Modernity's Frail Climate," 585.
138. Blackbourn, *Conquest of Nature*, 8–9, 76–77, 90, 105–108.
139. On the consensus around deforestation and flooding in the nineteenth century, see Deborah R. Coen, *Climate in Motion: Science, Empire, and the Problem of Scale* (Chicago, 2018), 243–44, 268–69.

140. Forster, *Ansichten*, vol. 1, 316–17; Jonathan Sperber, *The European Revolutions: 1848-1851*, 2nd ed. (New York, 2005), 40–42, 124–127; idem., *Rhineland Radicals: The Democratic Movement and the Revolution of 1848-1849* (Princeton, 1991), 58, 72–73.

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