Nature and Human Nature

Environmental Influences on the Union's Failed Peninsula Campaign, 1862

Scholars have long tried to explain why Union general George McClellan's campaign to capture Richmond, Virginia, in the summer of 1862 failed. With the exception of some limited attention to weather and terrain, Civil War historians have essentially ignored the complex natural world in which McClellan made his critical decisions. Employing methodology from both environmental and military history provides new insights into the actions of both Union and Confederate armies. The environment McClellan encountered brought out the worst in the general, magnifying the personal traits and quirks that led to some of his most baffling command decisions. Simultaneously, Confederate forces used nature to their advantage, employing strategies that allowed their armies to stave off a potentially devastating conquest of Richmond.

In the spring of 1862, Gen. George B. McClellan led the largest army in American history to the eastern peninsula of Virginia. He intended to defeat rebel forces, capture the Confederate capital at Richmond, and end the war. Given the impressive size of the Union's Army of the Potomac, its success seemed promising, even inevitable. However, McClellan proceeded cautiously, besieging Yorktown for a month before slowly moving his army up the peninsula. He fought a few small battles as he laboriously approached the gates of Richmond. On June 26, Gen. Robert E. Lee, the new commander of the Confederate army, launched an attack on McClellan's forces. Despite the proximity to his goal and his material and manpower advantages, the Union commander abandoned the offensive and ordered a retreat south to Harrison's Landing on the James River. Lee attacked McClellan's army five times over the course of a week, during what became known as the Seven Days' battles. Although McClellan won two of those engagements and inflicted heavier casualties on an outnumbered opponent, he nevertheless continued the retreat. In early August, after a month of sweltering inactivity at Harrison's Landing, McClellan received

orders to remove his army from the peninsula, ending the campaign to capture Richmond.

Scholars have spilled much ink trying to explain what happened that fateful spring and summer. Many historians have criticized McClellan for being too cautious, giving in to unrealistic fears, or being an inflexible commander who could not adapt to his military situation. When McClellan ordered the army's retreat to continue on July 1, 1862, after a clear victory over Confederate forces at Malvern Hill, one of his division commanders, Gen. Phil Kearny exploded, "Such an order can only be prompted by cowardice or treason!" Stephen Sears, McClellan's foremost biographer, leans toward the former, claiming that McClellan simply "lost the courage to command." However these historical interpretations differ in points of emphasis, they all are human-centric. With the exception of some limited attention to weather and terrain, Civil War historians have essentially ignored the complex natural world in which McClellan made his critical decisions. The physical environment has usually been little more than a backdrop for human action.[1]

If military historians have been slow to account for the environment, then environmental historians have been equally reluctant to turn their attention to the Civil War. Only in the last decade and a half have scholars of history and nature begun to investigate the ways the war changed Americans' relationships to the natural world. Some of those historians have cast the war as a struggle for resources, pointed to the crucial issues of soldiers' health, and focused attention on Americans' reactions to wartime destruction of the natural and built environment. A few studies have centered on individual campaigns, paying attention to the impact of weather, terrain, and other natural phenomena.[2]

What we lack, however, is a treatment of the war as an ecological event that not only affected people but also altered natural systems and reshaped the already complex interaction between humans, other organisms, and the physical environment. Such a history requires merging traditional military sources with material from relevant sciences, scholarly territory often unfamiliar to historians. This approach also grants agency to the natural world, not as the sole determinant of events but as a prominent and often neglected actor in a complicated story. As environmental historian Ellen Stroud writes, paying attention to the "material stuff of nature"—rain, dirt, bacteria and viruses, animals, and human bodies—does not mean that one ignores human action and decision-making. Instead, giving equal time to nature provides a new context, a means "of telling better histories," a way "to bring to light connections, transformations, and expressions of power that otherwise remain obscured."[3] So it is with the Peninsula campaign.

A look through an environmental lens reveals new ways to understand the actions of both Union and Confederate armies. The environment McClellan encountered brought out the worst in the general, magnifying the personal traits and quirks that led to some of his most baffling command decisions. At the same time, Confederate forces used nature to their advantage, employing strategies that allowed their armies to stave off a potentially devastating invasion of Richmond.

The decision to march up the peninsula to the Confederate capital grew out of McClellan's disrespect for and distrust of his commander in chief. President Abraham Lincoln preferred a more direct overland approach to Richmond from Washington, D.C. Instead, Little Mac (as McClellan's soldiers dubbed him) originally devised an elaborate plan to outflank rebel forces by transporting his troops by boat, down the Potomac River to Chesapeake Bay, then up the Rappahannock River to Urbanna, Virginia, about fifty miles northeast of Richmond. Before that plan could be enacted, Confederate general Joseph E. Johnston unexpectedly pulled his army back from Manassas to Fredericksburg on the Rappahannock River, negating the advantages of the Urbanna landing. Unwilling to concede any strategic point to Lincoln, McClellan quickly decided to move his army to Fort Monroe at the eastern tip of the Virginia Peninsula and march west to the capital—a move that even he had previously described as a last resort. As Little Mac explained it, "the worst coming to the worst, we can take Fort Monroe as a base, and operate with complete security, although with less celerity and brilliancy of results, up the Peninsula." Lincoln remained less sanguine about the plan but reluctantly agreed to the ambitious strategy.[4]

By late March 1862, the Young Napoleon (another nickname McClellan relished) had begun transporting to Fort Monroe an army that would eventually consist of over 110,000 men, 40,000 horses, 4,000 wagons, and nearly 250 pieces of artillery. Witnessing the massive army—an assemblage of people and animals larger than any city in Virginia—a British observer noted that McClellan came ashore with "the stride of a giant." Little Mac seemed keen to move quickly. On April 4, he began to march 60,000 soldiers toward Yorktown, about twenty-five miles away. His enthusiasm lasted exactly one day.[5]

Having progressed fewer than fifteen miles, McClellan awoke to a driving rain on April 5. As he contemplated the foul weather, the general read an astonishing message from his advance corps commander, Erasmus D. Keyes, stating that Confederate troops had formed a strong defensive line behind the Warwick River. Keyes's news made it clear that one of McClellan's maps, drawn by topographical engineer Col. Thomas Jefferson Cram, was badly flawed. The map, which the general had studied in advance, showed

the Warwick River flowing west to east, roughly parallel to the James. Indeed, after perusing Cram's work, McClellan had considered deploying gunboats on the Warwick to protect his left flank as he moved toward Richmond. Only in the middle of a downpour did McClellan realize that the Warwick actually flowed south from near Yorktown *into* the James. Instead of a potential avenue of support, it was an obstacle, one that now protected a Confederate line. The rebel commander, Gen. John Bankhead Magruder, had chosen the position carefully. Thick leafy woods along the Warwick provided ideal cover for the southerners, preventing McClellan from accurately estimating the size of the force that opposed him.[6]

Under the best circumstances, the flawed map and the discovery of Magruder's troops might have given McClellan pause. The weather, however, helped create a serious crisis of confidence that radically altered the course of the campaign. Spring rains were common in Virginia. North America has what geographers describe as a "continental" climate. In simple terms, that classification means that the land mass is generally dry, with most precipitation occurring during the warm months. Even so, the heavy precipitation that greeted McClellan that April proved something of a meteorological fluke. Like everything else in nature, climates fluctuate, moving subtly toward colder or warmer temperatures and toward more or less precipitation. Whatever the long-term trends, these variations, known as "oscillations," can have a profound effect on immediate weather conditions. One of the most influential of those variations is the El Niño Southern Oscillation, or ENSO. It results from shifts in temperature and atmospheric pressure across a vast expanse of the Pacific Ocean, changes that can dramatically influence the weather in the western and southern United States, including the Virginia Peninsula. Within ENSO, two smaller oscillations, now well known to modern Americans, are El Niño, a tendency toward warmer Pacific Ocean temperatures, and its counterpart, La Niña, which brings cooler ocean currents. Generally speaking, El Niño brings cooler, wetter weather to the American South; La Niña usually spawns warmer, drier conditions. Between 1856 and 1865, influenced by La Niña, the western and southern United States endured substantially diminished rainfall. Conditions across the two regions proved so abnormally dry that climatologists (working with computer models and data gleaned from tree ring analysis) refer to the period as "The Civil War Drought."[7]

As McClellan soon found out, an overall tendency toward dry conditions does not mean that it never rains or that precipitation falls at predictable intervals. The deluge that began on April 5 signaled the beginning of several days of heavy rain—in the middle of a drought. Accustomed to such chaotic weather, local residents along the Warwick had maintained two

dams to power local grist and saw mills. In a savvy strategic move that took advantage of the local geography, Magruder built three more dams that caused the overflowing river to flood established fords, submerge nearby roads, and create small swamps in the surrounding forests. If McClellan continued his advance, he would have to make use of the few remaining crossing points over those dams, all guarded by Magruder's thirteen thousand men ensconced in defensive works and supported by artillery. As Keyes explained to McClellan, to attack the Confederates in that position would result "in an enormous waste of life."[8]

Betrayed by a faulty map, and surprised by rain and flooded terrain, McClellan still outnumbered Magruder nearly five to one. But the cautious general refused to push that advantage; in fact, he became convinced that Magruder had a much larger force at his command. Accepting Keyes's assessment that a direct assault on the rebel position would cost too many lives, McClellan opted to lay siege to Yorktown, a key shift in strategy that required him to move his heavy guns to within range of Confederate defenses. After learning of the movement of the Union army, Joseph E. Johnston relocated his Confederate army to Magruder's position by April 14 and assumed overall command.[9]

The skies cleared briefly on April 6, but muddy roads around Yorktown made it difficult to move artillery into place. Then the rains returned, with a vengeance, affecting northern and southern troops alike. Over the next month as Union forces prepared for the siege of Yorktown, rain fell on sixteen of those thirty days, creating miserable conditions along the South's defensive line. Col. E. Porter Alexander, a Confederate artillery officer, recalled the sharpshooting on both sides as "exceedingly vicious," which meant that troops hugged the muddy earth constantly. "Our infantry lines were mere ditches with dirt thrown out in front," he wrote, "[and] these ditches in many places nearly filled with water in which the troops had to sit & stand day & night."[10]

By the time McClellan finally got his siege guns into place, the Confederates had abandoned their waterlogged fortifications. Johnston never held a high opinion of the position. Unimpressed by the efforts of Magruder's engineering officers in constructing the defensive works, Johnston snidely reported to Lee, "No one but McClellan could have hesitated to attack." After a short delaying action at Williamsburg on May 5, 1862, during which it rained steadily for almost twenty-four hours, the Confederate army began a retreat toward Richmond. Union forces slowly followed—and watched the skies.[11]

For a former engineer who prided himself on his planning abilities, McClellan apparently conducted little investigation of the terrain he would

traverse on the way to Richmond. The location of the Warwick River was not the only surprise that awaited the commander. Little Mac's chief engineer, Brig. Gen. John G. Barnard remarked that the region was "a terra incognita" for the army planners. "We knew the York River and the James River and we had heard of the Chickahominy," Barnard admitted, "[but] this was about the extent of our knowledge." Less than a week into the campaign, McClellan confessed, "The topography of the country was very different from what had been supposed." The further his army advanced, the more their ignorance showed. In May, McClellan admitted that his progress was so slow because "we have to feel our way everywhere; the maps are worthless."[12]

The unfamiliar landscape had been shaped as much by people as by nature. The peninsula's warm summers and plentiful spring rains had proven ideal for tobacco cultivation during the colonial period. By the 1860s, though, peninsula soils had been depleted. Farmers had turned away from tobacco in favor of wheat, corn, oats, and livestock—all of which could thrive on land that had been cultivated for more than two centuries. The landscape had evolved into a patchwork of cleared farmland, brushy old fields, and thick second-growth forests of loblolly pine, sweet gum, and red and white oak. Within those deep woods, plentiful springs and creeks occasionally formed nearly impenetrable swamps. To get their crops to market, peninsula farmers relied on a small but viable network of sandy roads. As McClellan planned his attack on Richmond, he knew he would have to depend on those same routes to move men and matériel. Confident in reports of the region's "good natural roads" that would support his wagons and half-ton artillery pieces, he believed he could get his troops into position to turn their guns on Richmond.[13]

Confederate leaders knew better and recognized their advantages. Gen. Lafayette McLaws, one of Magruder's division commanders, believed, "the tremendous odds against us can not be so formidable as elsewhere in more open country." He declared, "The country is so much cut up by these arms of the sea, called rivers, with their accompanying marshes and boggy freshwater tributaries that it is impossible to move through it except along the main roads."[14] The editor of the *Richmond Examiner* was even more optimistic. In early February 1862, six weeks before the first of McClellan's men left for the peninsula, the newsman wrote, "If his [McClellan's] troops push their invasion into the interior, they will have to become amphibious, and borrow some of the qualities of alligators and mud turtles. Instead of marching, they will have to wade against the secessionists."[15]

Those remarks proved prophetic. From May 14 through May 28, various locales across the peninsula recorded another ten days of rain. The

Figure 1
White Oak Swamp, Va. *A view of one of the swamps along the Virginia peninsula that obstructed the Army of the Potomac's advance and retreat during its campaign. (Courtesy of the Library of Congress Prints and Photographs Division)*

new downpours turned the peninsula roads into quagmire. Getting Union artillery through the mess proved especially difficult. McClellan brought forty-four artillery batteries to the peninsula; a battery typically consisted of six cannons, each weighing roughly twelve hundred pounds. Moving an individual gun required a six-horse team. In addition, each battery needed another eighty horses to pull the supporting ammunition caissons and supply wagons.[16] Roads that had been adequate for transporting local crops to market now gave way under the massive weight. Every hoof and wagon wheel cut deeper pockets and ruts that made the roads worse. The tiring conditions of the muddy roads, coupled with the lack of adequate forage for the horses, taxed the ability of even the strongest teams. Wagons loaded with food, forage for horses, and reserve ammunition sank into the muck.

Even before the siege of Yorktown, McClellan and his men marveled at the deep, sticky morass that surrounded them. As one Union soldier had noted on April 6, after wagons became stuck, "the mules wallowed in the mud and cleared themselves completely from their harness in one or two rolls. There was vehement swearing and lashing of whips by the teamsters when we would go 500 feet more ahead and stick again. This traveling was very tedious and did not help to keep any in good humor." On May 5, McClellan wrote Secretary of War Edwin Stanton, noting in near disbelief, "Several of our batteries are actually stuck fast in the mud. The men have done all that could be done." The mud frequently led to the death of many an overworked animal along the march. McClellan's troops came across abandoned Confederate wagons with dead mules "lying on their backs, half smothered in mud, with their feet sticking out of it."[17]

Neither McClellan nor his Confederate adversaries knew it, but the peculiar qualities of the Virginia mud resulted from geologic events that had occurred tens of thousands of years earlier. McClellan's route to Yorktown and Williamsburg took him straight across what geologists call the Norfolk Formation, a sedimentary structure laid down in the Pleistocene epoch (between 2.5 million and 11,700 years ago). Deposited by ancient rivers and estuaries, the sediment is best described as a kind of clayey sand. Because of the clay content, it drains poorly and is prone to flooding, especially in relatively flat terrain like that of the Virginia Peninsula. In places, McClellan's route also crossed the Windsor Formation, an older geologic unit that, where it intersected the general's path, has properties similar to the younger Norfolk Formation.[18]

In the intervening millennia between establishment of the sedimentary layers and McClellan's campaign, regular flooding of the York, James, and other nearby rivers had laid down alluvium near the surface that also contained a mix of sand, clay, and organic mud (or marl). Under moderately rainy conditions, the roads, which to the eye appeared sandy, could easily support farm wagons and light loads. However, during heavy rains, like those that fell on the peninsula in the spring of 1862, the clays of the soil and sediment beneath tended to absorb water. If agitated or compressed—in this case by thousands of horses, wagons, and heavy cannons—the clays underwent a process technically known as liquefaction. In layman's terms, the clay becomes an incredibly gooey mud that behaves more like a liquid than a solid, the sort of miry mess that that could indeed swallow wagons and suffocate mules. One geologically minded Union artillerist aptly described the soil as one or two feet of sand on top of marl on top of clay. "The immense rains we have had all this spring, sinking directly through

the sand and finding no outlet from the marl, have converted it into the consistency of soft mortar," he wrote. "When a heavy substance once breaks through the top soil, there is nothing to stop its sinking until it reaches the hard clay."[19]

Unaware of the region's geologic history and the origins of the freakish weather working against him, a frustrated McClellan described the roads and wet weather as "infamous," "frightful," or "execrable." He noted that the soft soils left the roads "impassable for trains after a day's rain, of which we have had a great deal."[20] Soldiers in both armies shared McClellan's incredulity about the conditions. "The roads are beyond description," wrote a Union chaplain. "Just imagine the worst roads possible, and then believe they are ninety-nine times worse than your imagination and you may then come near the truth." A Confederate soldier in Hood's Texas Brigade declared, "No one knows how hard a soldier's life is until he marches in the night over a muddy road with a heavy knapsack on his back." Another Confederate soldier concurred that with the "roads awfully muddy," the men in his unit were "nearly all broken down with fatigue, hunger, & want of sleep."[21]

Estimates suggest that a 143-pound man (the average weight for a Civil War soldier, according to one study) marching in mud burns approximately 545 calories per hour. Marches of eight to ten miles could take as many hours in the dreadful weather conditions.[22] Burning at least 5,000 calories a day, the advancing Union soldiers often had limited access to provisions, since most of the supply wagons were stuck in the mud to the rear. McClellan felt for his troops, confessing to his wife on May 6, "It is with utmost difficulty that I can feed the men, many of whom have had nothing to eat for 24 hours & more." Many of the equally weary retreating southern soldiers also went hungry because their commissary wagons sank into the mud, "many being compelled to throw out rations in order to get along."[23]

The daily rations provided enough calories to meet the minimum energy requirements for active soldiers—but few soldiers in either army could get a full allotment during the campaign. The 1860 U.S. Army ration guide (which Confederates emulated) called for each soldier to eat 20 ounces of beef or 12 ounces of pork or bacon; 18 ounces of flour or 20 ounces of corn meal; 1.6 ounces of rice or .64 ounces of beans or 1.5 ounces of dried potatoes; 1.6 ounces of coffee or .24 ounces of tea; .24 ounces of sugar, .54 ounces of salt, and .32 ounces of vinegar *each day*. The U.S. Congress amended the rations in August 1861 by adding four ounces of flour (or substituting one pound of hardtack for the entire flour ration) and a small quantity of desiccated vegetables to the ration. Confederate commissary

officers frequently made substitutions—more bacon and less beef, rice instead of beans or potatoes, cornmeal instead of flour—but they tried to adhere to the requirements.[24]

If a soldier ate only his daily rations, he consumed between thirty-five hundred and four thousand calories per day, depending on the type of meat, meal, and starch provided.[25] However, during the muddy slog from Yorktown to Richmond, stuck supply trains could not replenish empty haversacks. Thus, most soldiers consumed only a fraction of their daily caloric needs, further debilitating their bodies and increasing their vulnerability to illness. One Texas soldier wrote, "On the morning of [May] 8th, our haversacks being again empty, four ears of corn were dealt out to each man" (providing approximately three hundred calories) as the only sustenance during that day's retreat. Most of the calories the exhausted, sick, and hungry Union soldiers on the march consumed came in the form of the staple of their haversacks, the nonperishable (and barely digestible) hardtack—a reviled cracker largely devoid of nutrition. "Hard crackers and occasionally a little meat are our only diet," wrote one Union soldier in late April. Six weeks later, he complained that the basic diet had not changed, adding, "There is but little temptation to surfeit, to the detriment of health or comfort, on such fodder." As the army's medical director wrote of hardtack, "This bread is difficult to masticate, is dry and insipid, absorbs all the secretions poured into the mouth and stomach, and leaves none for the digestion of other portions of the food."[26]

To wash down their rations, soldiers in both armies frequently had to drink the foul water in the roads or nearby creeks. One Confederate private admitted that he and his comrades "would drink water from a stream that had dead horses in it. When you are so very thirsty, any kind of water is good." Another soldier recalled "drink[ing] water out of the road where the wagons, horses and men would wade through. It was muddy and tasted very badly." More fortunate troops could brew a cup of coffee, which brought pleasure to the taste buds at the same time it functioned as a diuretic and, together with the dry hardtack, exacerbated the endemic problem of soldiering, dehydration. While there are conflicting views as to how much water humans should consume, the U.S Department of Agriculture Dietary Reference Intakes (DRI) for water consumption recommends that men over the age of 18 should drink at least 3.7 liters (approximately 125 ounces) of fluids per day—more if engaged in strenuous exercise in a warm climate. Given the unreliability of water sources and the limited capacity of army canteens—usually no more than 1 quart, or 32 ounces—few soldiers drank their recommended daily allowance of water. Lack of proper hydration impedes the function of multiple organs and regulatory systems

in the body. Improper hydration only increased a soldier's risk of illness, especially when coupled with a diet high in salt and starch and lacking in fresh fruits or vegetables.[27]

As they drew closer to the capital, Union and Confederate soldiers found firmer (at least geologically speaking) ground beneath their feet. Near Richmond, the underlying sediment is coarser sand and gravel that drains better than the clayey sand to the east. The soils also allowed rainwater to pass through at a higher rate, meaning that the roads likely dried out quicker and were generally more passable than those farther down the peninsula. Once they settled into regular battle lines, the troops also benefitted from a steadier supply of food. By May 24, Little Mac's forces had advanced as far as Mechanicsville, only five miles from Richmond—close enough, in fact, for soldiers to hear church bells ringing in the city.[28]

Almost immediately, however, McClellan found himself facing another environmental obstacle. Perhaps because he expected reinforcements to join him from the north, McClellan divided his army as he approached Richmond, locating more than half his men north of the Chickahominy River. A relatively narrow, sluggish stream that begins northwest of Richmond, the Chickahominy flows southeast for eighty-seven miles through a low flat valley before it empties into the James River. Level bottomlands make the Chickahominy especially prone to flooding even during periods of moderate rain. By the time McClellan arrived, in late May 1862, the wet spring had turned the river and surrounding bottomland into a mile-wide swamp. Then, on the night of May 30, after two days of clear weather, some of the heaviest thunderstorms of the season rolled across Richmond. The unexpected downpour and ensuing flood delayed construction on some bridges and washed out others across the Chickahominy, leaving each branch of McClellan's divided army largely to fend for itself.[29]

On May 31, sensing an opening that might allow Confederate forces to engage fewer than half of McClellan's troops, Johnston launched a surprise attack on Federal forces at Seven Pines, south of the Chickahominy. Confusion and communication problems within the southern leadership led to a mismanaged attack that failed to dislodge the Union army. Even so, the two-day battle at Seven Pines cost the two sides over eleven thousand casualties combined. The most significant of these was General Johnston himself, who suffered a debilitating wound that forced him to give up command of the southern forces. The next day, President Jefferson Davis entrusted Robert E. Lee with the defense of Richmond and the future of the Confederate army.[30]

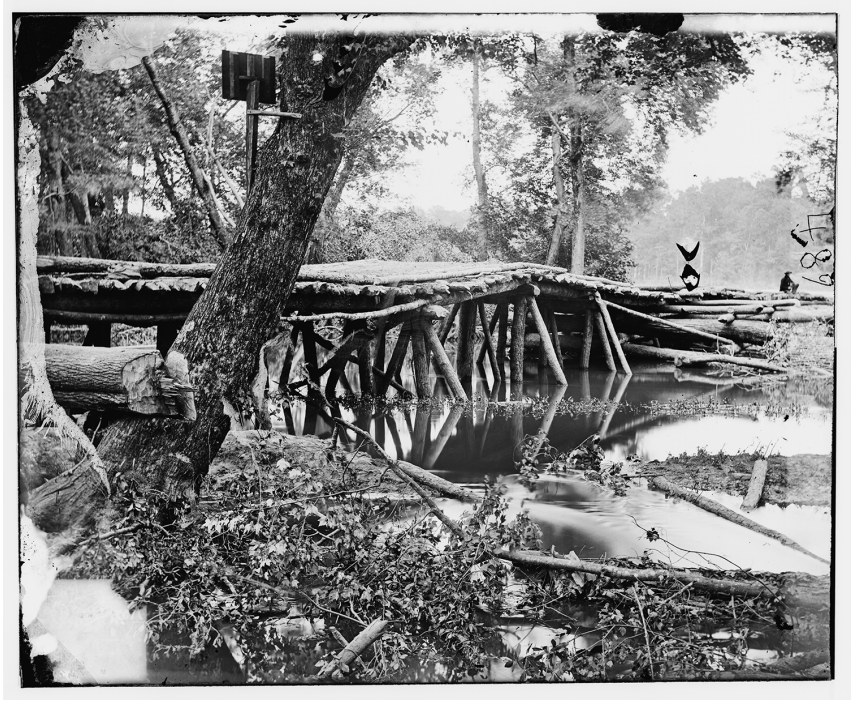

Figure 2
Chickahominy River, Virginia. Military Bridge across the Chickahominy, Built by the 15th New York Volunteers under Col. John McL. Murphy. *(Courtesy of the Library of Congress Prints and Photographs Division)*

Had McClellan been able to move his heavy siege guns into range of Richmond soon after Seven Pines, Lee might well be remembered as the Confederate general who lost the capital (and perhaps the war). Instead, it rained—again—almost incessantly for the first four days of June. After a clear day on June 5, wet weather returned on the sixth, seventh, eighth, and tenth. Already seething because Lincoln had denied him the reinforcements he desired, McClellan now railed against the elements. "It is again raining hard & has been for several hours! I feel almost discouraged," McClellan wrote to his wife on the night of June 10. "It is certain that there has not been for years & years such a season," he lamented. "I am quite checked by it—first the Chickahominy is so swollen & the valley so covered with water that I cannot establish safe communication over it—then again the ground is so muddy that we cannot use our artillery—the

Figure 3
Fair Oaks after the Battle, Burying the Dead—and Burning the Horses. Tuesday 3rd June, *by Alfred R. Waud. The Battle of Fair Oaks, also known as the Battle of Seven Pines, put McClellan and the Army of the Potomac on the defensive for the remainder of the campaign. (Courtesy of the Library of Congress Prints and Photographs Division)*

guns sink up to their axle trees." Lee faced the same conditions; he echoed McClellan when he wrote Jefferson Davis, "You have never seen roads like those in the Chickahominy Bottom." But he understood that the longer the rain stymied McClellan, the better the Confederate chances for a successful counterattack.[31]

Following Seven Pines, soggy conditions brought fighting to a near standstill for three weeks as McClellan deemed the ground too wet to move his heavy guns to the front. While the rains fell, Lee planned carefully for an offensive against the Union troops. He first sent his cavalry commander, James Ewell Brown "Jeb" Stuart to scout McClellan's dispositions. Upon discovering that McClellan had weakened his right flank, Lee recalled Stonewall Jackson's troops from the Shenandoah Valley to spearhead an attack against McClellan's remaining forces north of the Chickahominy. On June 26, Lee launched an attack near Mechanicsville. Jackson was supposed to arrive on the Union right and rear, but "high water and mud" delayed him, causing the supporting Confederates to launch futile frontal assaults on a well-fortified Union position. Though the battle was a tactical failure for Lee, it proved to be a strategic success.

Convinced that Lee's army outnumbered his—which it did not—McClellan decided late that night to abandon his offensive and move his army due south across the peninsula to Harrison's Landing on the James River. There, Union forces might resupply themselves water and be protected by gunboats. During these Seven Days' Battles, Lee repeatedly attacked McClellan's forces as they moved to the James River. During the retreat, McClellan's army fought four separate battles—at Gaines Mill on June 27, a costly Confederate victory; Savage Station on June 29 and Glendale on June 30, both tactical draws; and Malvern Hill on July 1, a Union victory. McClellan suffered nearly 16,000 battle casualties that week, out of 114,000 troops, while Lee lost slightly more than 20,000 of the approximately 90,000 soldiers in his army.[32]

Bayonets and bullets were not the only threats to McClellan's men. As medical historian Paul Steiner discovered, and detailed in a book published in the 1960s that has not gotten the attention it deserves, sickness crippled the Union army while it camped closer to Richmond. Enlisted men called it "Chickahominy Fever," or, with reference to the bowel symptoms, "the Virginia Quickstep." Typified by diarrhea, nausea, fatigue, and a rise in body temperature, the affliction sometimes killed but more often left soldiers too sick and weak to fight. In all likelihood, Chickahominy Fever resulted from a combination of ailments, nearly all of them made worse by rain and crowded conditions.[33]

Typhoid fever, resulting from the bacteria *Salmonella typhimurium* and *Salmonella paratyphi,* usually proved easiest for surgeons to diagnose. Along with fever and diarrhea, typhoid produced a distinctive rose-spotted rash that set it apart from other digestive diseases. Other symptoms, including intestinal bleeding, delirium, and severe stupor sometimes followed. The most acute cases resulted in kidney failure and death. Those who survived began to show signs of recovery in about four weeks but remained in a weakened state for much longer.[34]

Humans are the only reservoirs and carriers for *Salmonella typhi* and *paratyphi*. Infected individuals pass the bacteria onto the landscape in their stool, a process that can go on for up to a year after a person recovers from the disease. The Virginia Peninsula, with its permeable soils, countless streams, and a water table that lay close to the surface offered nearly ideal environmental and geographical conditions for the propagation of the *Salmonellae*. Able to live for weeks outside the body, the bacteria easily found their way into the sluggish streams and groundwater. Indeed, the disease might have been one of several that killed two thirds of the original English colonists as they holed up for the winter of 1608 in their fort at Jamestown. By 1861, though, typhoid fever had become far less prevalent

as settlement spread out across the coastal plain and into the piedmont and mountains and those who survived typhoid fever acquired immunity. Most local communities simply lacked the highly concentrated human population and nonimmune human hosts necessary to sustain the bacteria.[35]

All of that changed as thousands of soldiers converged on the peninsula. From a biological standpoint, deployment of Confederate and later Union forces to Virginia amounted to a huge human migration, one that suddenly offered *Salmonellae* a multitude of new hosts. Officers in both armies knew to locate latrines, "sinks," in military parlance, away from sources of clean drinking water. Leaders also issued orders to police the camps daily to remove trash and filth. But such regulations did little to slow the spread of typhoid fever. Too weak to stumble toward the latrines or unable to reach them in time, sick soldiers often defecated near their tents. As a result, the bacteria flourished in proximity to the cooking fires. When it rained, human waste from the landscape washed into the surrounding streams and invaded the water table. Consumed by sick and healthy alike, tainted food and water perpetuated the insidious ecological cycle. As Gen. Régis de Trobriand noted, the Union army's "sanitary condition became worse from day to day." By the time the campaign ended, nearly seventeen hundred Union soldiers had been formally diagnosed with typhoid.[36]

Any bowel complaint that could not be readily identified as typhoid usually got classified as "diarrhea" or "dysentery." Modern physicians, though, recognize the two as separate problems. Technically, diarrhea is a symptom, not a disease, and is common to a variety of ailments. Dysentery *is* a disease that usually manifests itself as diarrhea with mucus and/or blood in the stool. Though it can result from amoebic parasites, milder bouts of dysentery more often stem from one of several species of *Shigella*, an organism that lives in human stool. Ingesting even a tiny portion, such as a particle of feces too small to see, can be enough to infect an otherwise healthy person. *Shigella* often passes from one person to another via contaminated food or water and can be spread by flies.[37]

More severe bouts of dysentery that persisted for several weeks or months likely resulted from other bacteria, including *E. coli* and various strains of *Salmonella* other than *Salmonella typhi* and *paratyphi*. Many varieties of *E. coli* inhabit the intestines of humans and other warm-blooded animals. Most of these pose no threat of disease and actually aid digestion, but some can be agents of dysentery, either by themselves or via production of a toxin that causes intestinal distress. As medical historian Margaret Humphreys writes, "the Civil War soldier lived amid a soup of fecal organisms" and every soldier—Union and Confederate—likely suffered from

bowel maladies at some point in their service. Walt Whitman, a nurse in Union hospitals, put it more succinctly, observing that the "war business is about nine hundred and ninety-nine parts diarrhea to one part glory." Over the course of the war, Union medical personnel recorded nearly 1.75 million cases of dysentery and diarrhea. Some 57,265 soldiers died from various intestinal disorders or attendant complications. Due to loss of records, Confederate statistics are not nearly as comprehensive, but southerners probably suffered at similar or even worse rates.[38]

Months after the Peninsula campaign ended, many Union soldiers still battled chronic diarrhea, of which one Vermont soldier lamented, "We contracted in the swamps of the Chickahominy, and which saps the foundations of one's strength, and makes his existence a lingering duration of misery." McClellan's men did not know the science, but they did understand the environmental origins of their illnesses. During the campaign, many exhausted, hungry, and sick soldiers sought unauthorized relief. They left their commands temporarily in order to find shelter, food, or recover their strength. Kathryn Shively Meier argues that such "straggling" was often a "self-care" employed to improve one's health and morale.[39]

Along with dysentery and typhoid, Union soldiers suffered from dietary deficiencies. Daily rations typically lacked suitable quantities of fruits or vegetables, which provided necessary vitamins. Congress authorized adding fresh vegetables (or their equivalent) to the Union ration in August 1861, but the army delivered primarily dried vegetables, which proved extremely unpopular. When scurvy broke out while the soldiers camped outside Richmond, the army's chief surgeon, Charles Tripler, called on the commissary director to see why he was not furnishing the men with the required vegetables. He discovered that "the men very generally refused to use the desiccated vegetables; the [commissary] had an abundance of them, and could not get rid of them." Well aware of complaints that scurvy might wreck "the fighting power of the army," Tripler moved to remedy the problem. On June 17, he ordered large supplies of lemons and reiterated calls for officers to make their men eat the hated dried vegetables. But Lee's attack on the Union army began nine days later, before these efforts could be comprehensively implemented.[40]

Thunderstorms pelted the weakened Union troops as they retreated, especially during the nights of June 29 and July 1. Pvt. Robert Knox Sneden recalled the night of June 29: "The long pent up rain now came down in torrents, while the thunder crashed and roared, and lighting blinded us and scared the horses." As Little Mac's men knew all too well, such conditions could exhaust the most intrepid soldier. Sneden noted that the sandy

roads were better drained than those encountered further east on the peninsula, and he recognized their good fortune: "If we had to go over the red mud roads we would have hopelessly stuck in the mud all night and the enemy would have overtaken us." Still, it was a rough slog, as ten horses had to be harnessed to each artillery piece to get it through the mud. After four days and nights of fighting, marching through mud, and surviving on scanty rations, many of McClellan's men were on the verge of collapse. With "infantry, cavalry, artillery, mules, horses, and stragglers . . . promiscuously mixed without much order," during the hellish storm, Sneden concluded, "The confusion which attended the march . . . was very considerable and demoralizing."[41]

The same conditions that exhausted the soldiers affected the animals that moved McClellan's equipment and supplies. A great many horses and mules, weak and malnourished, collapsed. Usually troops simply left the animals to die by the roadside. To remain healthy, an average 1000-pound horse needed 14 pounds of hay and 12 pounds of grain per day (mules required three fewer pounds of grain). Thus, by the time of the Seven Days' campaign, the remaining twenty-five thousand horses and mules in the Army of the Potomac still needed approximately 175 tons of hay and 150 tons of grain daily. Meeting such staggering demands while on campaign was extremely difficult, especially because most of their rations had to be transported along with other supplies.[42]

Animals that survived the brutal pace added a peculiar hazard of their own. To be sure that Confederate forces did not capture the Union beef supply, some twenty-five hundred head of cattle walked ahead of the retreating soldiers, in addition to the horses and mules pulling Union artillery and supply wagons and carrying officers and cavalry troopers. Those beasts chewed up the roads with their hooves and left thousands of noxious "pies" in their wake. Modern estimates suggest that a healthy 1000-pound horse or mule produces an average of 50 pounds of manure and six gallons of urine in a typical day. Those numbers can vary about 30 percent up or down, depending on an individual animal's food and water intake. Allowing for inadequate nourishment among the horses and taking the lowest possible estimate (35 pounds of manure and four gallons of urine per animal per day), Union horses and mules left nearly 440 *tons* of solid waste and more than 100,000 *gallons* of liquid effluent on the peninsula *every day*. During the retreat, much of that waste fell on the roads directly in the path of the soldiers. The rainy weather meant that soldiers had to trudge through a shin-deep stinking stream of mud and excrement. Dehydrated and exhausted, Union soldiers were "glad to drink rainwater which had settled in the wheel ruts made by the passing artillery," and, of

course, they also swallowed all the associated fecal bacteria that resided therein. Small wonder that so many soldiers were sick by the time they reached their destination.[43]

As if by design, when McClellan's army reached Harrison's Landing on July 2, the rain that had plagued the campaign suddenly stopped. On the peninsula, temperatures soared as the southern summer set in, bringing the decade-long drought back with it. A week after Malvern Hill, McClellan wrote his wife, "The day is insufferably hot—intense—so much so that I have suspended all work on the part of the men." By August, even the usually loquacious general had run out of words to describe the sweltering conditions: "I can't convey the idea of the heat today . . . not a breath of air stirring." It only rained while McClellan was on active campaign; it seemed to cease the moment that he stopped.[44]

The ecological chaos induced by the campaign, however, did not end when the skies cleared. As spring turned into summer and McClellan's men settled in at Harrison's landing, they found themselves battling clouds of mosquitoes, some of which carried the parasites responsible for malaria. By the early 1860s, a milder form of malaria, *Plasmodium vivax,* had become endemic in parts of the Midwest and more northern climes. A more virulent and potentially deadly variety, *Plasmodium falciparum* and commonly called "pernicious malaria," had settled into the coastal and Deep South. Military officers and surgeons knew both diseases well, though they remained ignorant of how they spread. Like doctors everywhere, they associated the disease with putrid air or vapors emanating from swamps, rotting vegetation, or stagnant water. Indeed, the term "malaria" derived from Italian words for "bad air."[45]

Malaria has a complicated ecology, but essentially, it requires three things to sustain itself among people: parasites, anopheline mosquitoes, and nonimmune human hosts. A female mosquito (males do not spread the parasites) bites an infected victim, imbibing the *Plasmodium*. In search of blood meals to facilitate breeding, the parasite-carrying mosquito—the most common carrier in the United States is a species known as *Anopheles quadrimaculatus*—bites an uninfected person and injects the parasites into the bloodstream. From there, the *Plasmodia* move to the liver, where they multiply, alter their form, and attack cells within that organ. Infected liver cells swell and burst, releasing large numbers of parasites back into the bloodstream, where they infect red blood cells. As the affected cells rupture, the victim experiences the telltale fever spikes, chills, sweating, and nausea. In time, as the body marshals its defenses against the infection, the parasites retreat to the liver, where they multiply and start the cycle over again. This pattern of acute symptoms, recovery, and relapse can

persist for years if the disease remains untreated. Though the parasites, especially the more virulent *P. falciparum*, can kill, malaria more often debilitates a victim and lowers resistance to more serious and deadly secondary infections, such as pneumonia.[46]

Because anopheline mosquitoes need fresh, slow-moving water in which to lay their eggs, the local environment also plays an important role in sustaining malaria. The vectors prefer freshwater with rooted or floating vegetation that conceals larvae from predators. Swamps, ponds, and sluggish streams all provide suitable habitats, as do rain barrels, drainage and irrigation ditches, rutted roads, and other trappings of human settlement in which water and detritus accumulate. In regions where malaria had become endemic, including the Virginia Peninsula, the machinations of war scrambled long-established relationships between parasites, vectors, and hosts. Armies brought nonimmune men into prime anopheline and *P. falciparum* habitat. Wagons and artillery left ruts that filled with rainwater. Soldiers constructed fortifications, ditches, and latrines, unwittingly providing more breeding sites for *anopheles quadrimaculatus*. Recruits from the Ohio Valley and other temperate northern regions sometimes brought *P. vivax* into Union camps. Slaves in Virginia, some of whom benefitted from acquired or genetic immunity to both forms of malaria, inadvertently furnished another source of potential infection for their Yankee liberators.[47]

Though malaria might not kill, the spiking fever, chills, nausea, and dehydration "severely undermined an individual's health, causing malnutrition, cerebral anemia, and cognitive impairment." Soldiers battling malaria became more susceptible to respiratory infections or death from dysentery and diarrhea. Even McClellan battled a recurrence of what he called his "Mexican disease," probably the malaria he contracted during the Mexican War. During the Peninsula campaign, nearly fifty-three hundred Union soldiers were formally diagnosed with it. By the time the war ended, approximately 1.3 million Union soldiers had contracted the disease.[48]

The new Union medical director, Jonathan Letterman, who joined the army on July 1 and accompanied it to Harrison's Landing, could scarcely believe the weakened state of McClellan's men. "The malaria from the borders of the Chickahominy and from the swamps throughout the Peninsula," Letterman wrote, "now began to manifest its baneful effects upon the health of the men." Marching nearly nonstop, the troops often struggled to prepare food. "They had little time for sleep, and even when the chance presented itself it was to lie in the rain and mud." Additionally, he declared that widespread illnesses such as scurvy "undermine the strength, depress

the spirits, take away the energy, courage, and elasticity of those who do not report themselves sick, and who yet are not well. . . . In this way it had affected the fighting power of the army, and much more than was indicated by the numbers it had sent upon the reports of the sick." Medical officers also succumbed to illness, leaving fewer doctors to treat the increasing number of sick and wounded. At Harrison's Landing, sickness incapacitated more than 20 percent of McClellan's army. Disease affected the highest ranks as well. McClellan was annoyed that more than twenty generals made application for sick furloughs in early July. A month later, ten thousand soldiers still remained incapable of taking the field.[49]

A higher percentage of soldiers in the Army of the Potomac were sick in July 1862 than in any other month of the war. Of the 106,069 soldiers listed on its rolls, more than 40,000 cases of illnesses were reported, with an astounding 19,776 soldiers afflicted with diarrhea or dysentery. Only October 1862 would find more soldiers suffering from those ailments (21,234); however, not only was that from a much larger army (171,258 soldiers), but also many were chronic cases that had developed on the banks of the Chickahominy. On July 4, Letterman found McClellan's troops so sick and exhausted that he drew up a lengthy prescription for their recovery, including a diet rich in fresh vegetables, proper shelter from the elements, and plenty of rest. Unfortunately, Harrison's Landing was not a particularly healthy place for the army to camp either, and sickness continued through the summer. Though McClellan called for reinforcements to launch another attack on Richmond, some of his generals strongly disagreed. Keyes wrote to Lincoln strenuously urging the president to withdraw the army from the unhealthy peninsula. He implored, "To bring troops raised at the North to the country in the months of July, August, and September would be to cast our resources into the sea." On August 3, 1862, McClellan finally received orders to abandon the peninsula, ending the campaign.[50]

From the moment Union troops landed at Fort Monroe until they left the peninsula, every decision McClellan made reflected the natural environment in which the campaign took place. Accounting for the place of nature in war is hardly a new concept. Natural forces, especially weather, loomed large in Prussian military theorist Carl von Clausewitz's ideas about "friction"—a key concept that distinguished "real war from war on paper." Under battlefield conditions, Clausewitz believed, victory or defeat might hinge on the deeds or decisions of a single person. Such individual actions could perhaps be explained, especially in retrospect, but they could never be anticipated. Clausewitz argued that weather played a similar role

in war: "Rain can prevent a battalion from arriving, make another late by keeping it not three but eight hours on the march, ruin a cavalry charge by bogging down the horses in mud, etc."[51]

According to environmental historian Lisa Brady, Clausewitz's concept of nature as friction has much in common with chaos theory or nonlinear dynamics, two concepts useful in explaining human interaction with the natural world. Simply put, people act and make decisions in "hybrid environments," created by "ever-changing fusions of human and non-human actors and activities." Commanders like McClellan execute military strategies in real time on the physical battlefield where weather, microbes, soils, animals, and soldiers commingle to create a shifting environmental mosaic, one influenced as much by nature as by human nature. The true test of a general's merit, Clausewitz believed, lay in his ability to "know friction" and to adjust his tactics and expectations to accommodate and overcome the unexpected.[52]

As Clausewitz seemed to understand, acknowledging nature's agency in the Peninsula campaign does not absolve McClellan of responsibility for the Union defeat. Indeed, viewed in the context of a hybrid environment, Little Mac's decisions become not only more nuanced and understandable but also more open to criticism and interpretation. Comparisons using modern weather data suggest that the spring and summer of 1862 might have been only slightly wetter than usual. What seems more important is the *manner* in which the rains came to the peninsula that year, falling for several days or a week at a stretch in April and May and again in early June (when some rain fell on each of the first ten days of the month). It also rained frequently in late June and early July. The timing of the precipitation—a fine example of nature's friction and agency—forced McClellan to modify and reevaluate his plans.[53]

Those adjustments inevitably reflected McClellan's reactionary style and his lack of aggressiveness, traits that would ultimately get him relieved of command. At Yorktown, he delayed his advance and opted for a siege, a favorite and well-tested tactic that, on this occasion, allowed the enemy time to retreat to a defensive position around Richmond. Caught in the rains along the Chickahominy, he responded by delaying his planned attack on the capital. That delay allowed Lee time to plan the offensives of the Seven Days. Once Lee attacked, McClellan decided to retreat and regroup at Harrison's Landing. Even after Lee exhausted his army in five bloody attacks over the week and lost the culminating battle of Malvern Hill, McClellan refused to consider a counterattack and opted to continue the retreat. In short, he failed to adjust his tactics and objectives in ways that might have allowed for success, even in the rain.

The odd, at least by human standards, pattern of precipitation—which might have stemmed from climatic oscillations thousands of miles away in the Pacific Ocean—was but one source of friction as the Union army moved up the peninsula. Simply by bringing over a hundred thousand men and tens of thousands of animals to the region, the Union offensive set in motion complex ecological forces that contributed mightily to Little Mac's failure. Owing to the unique properties of eastern peninsula soils, rain-soaked roads gave way under heavy artillery and swallowed horses and mules. The sudden increase in the human population provided new environments in which old microbes and mosquito-borne parasites could thrive, while malnutrition and the stress of marching through mud left bodies weak and especially vulnerable to infection. As medical and agricultural historian G. Terry Sharrer has suggested, the fighting might be regarded "as a secondary terror, happening in the midst of an unprecedented pandemic—not of one disease widely spread, but of many all at once." McClellan responded to the new disease environment the same way he reacted to the rain. He delayed, retreated, rested, and requested reinforcements.[54]

The same rain fell on Confederate troops, and the same microorganisms found suitable habitats in rebel bodies. Incomplete records make it difficult to gauge with any precision how southern forces fared that spring. What we do know is that Magruder turned the rain to his advantage by flooding the terrain along the Warwick River, an adjustment to the weather that drove McClellan to lay siege to Yorktown. We also know that Johnston and Lee essentially maintained a defensive position until the final week of the campaign. That proved a far more advantageous response to the rainy conditions than McClellan's ongoing struggle through the Chickahominy swamps. From their position, Confederate troops had access to the city's hospitals and private homes that could provide care for the sick. The same rain that stopped McClellan during the first ten days of June allowed Lee time to prepare for his counteroffensive that ultimately drove Little Mac to Harrison's Landing.

McClellan launched his offensive at the worst possible moment in the worst possible location. Approaching Richmond via the direct route from Washington over more stable soils or embarking two months later might have led to a different outcome. Had McClellan succeeded in taking the Confederate capital, the war might have ended before President Lincoln ever issued the Emancipation Proclamation. As it was, the South extended the war, gaining a legend for posterity in "Marse Robert" but ultimately giving birth to a "hard war" policy that destroyed the peculiar institution that served as the war's raison d'être. It is impossible to divorce McClellan's

actions from the natural environment in which they occurred. He was unprepared to deal with the environmental factors and unable to adapt to them. Nature, as much as human nature, sealed McClellan's fate.[55]

NOTES

1. Stephen Sears, *To the Gates of Richmond: The Peninsula Campaign* (New York: Ticknor & Fields, 1992), 338, 28. For just a few of the interpretations of McClellan's failures, see also Kenneth P. Williams, *Lincoln Finds a General*, vol. 2 of 5 (New York: Macmillan, 1949); Brian K. Burton, *Extraordinary Circumstances: The Seven Days Battles* (Bloomington: University of Indiana Press, 2001); Judkin Browning, *The Seven Days' Battles: The War Begins Anew* (Santa Barbara, Calif.: Praeger, 2012); Chester Hearn, *Lincoln and McClellan at War* (Baton Rouge: Louisiana State University Press, 2012).

2. Among those scholars who have taken up the study of the war and nature are Jack Temple Kirby, "The American Civil War: An Environmental View," *Nature Transformed: The Environment in American History*, National Humanities Center Web site, accessed September 1, 2012, http://www.nhc.rtp.nc.us/tserve/nattrans/ntuseland/essays/amcwar.htm; Ted Steinberg, *Down to Earth: Nature's Role in American History* (New York: Oxford University Press, 2002), 89–98; Margaret Humphreys, *Marrow of Tragedy: The Health Crisis of the American Civil War* (Baltimore: Johns Hopkins University Press, 2013); Andrew McIlwaine Bell, *Mosquito Soldiers: Malaria, Yellow Fever, and the Course of the American Civil War* (Baton Rouge: Louisiana State University Press, 2010); Megan Kate Nelson, *Ruin Nation: Destruction and the American Civil War* (Athens: University of Georgia Press, 2012). On the role of the environment in strategy and campaigns, see Lisa M. Brady, *War upon the Land: Military Strategy and the Transformation of Southern Landscapes during the American Civil War* (Athens: University of Georgia Press, 2012); Mark Fiege, *The Republic of Nature: An Environmental History of the United States* (Seattle: University of Washington Press, 2012), 199–227; Brian Allen Drake, ed., *The Blue, the Gray, and the Green: Toward an Environmental History of the Civil War* (Athens: University of Georgia Press, 2015); Kenneth W. Noe, "Heat of Battle: Climate, Weather, and the First Battle of Manassas," *Civil War Monitor* 5 (Fall 2015): 54–63, 76; Kathryn Shively Meier, *Nature's Civil War: Common Soldiers and the Environment in 1862 Virginia* (Chapel Hill: University of North Carolina Press, 2013).

3. Paul S. Sutter, "Epilogue: Waving the Muddy Shirt," in Drake, *The Blue, the Gray, and the Green*, 228–29; Ellen Stroud, "Does Nature Always Matter? Following Dirt through History," *History and Theory* 42 (December 2003): 80.

4. Sears, *To the Gates of Richmond,* 9–20; George McClellan to Edwin Stanton, February 3, 1862, in *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies,* 108 vols. (Washington, D.C.: GPO, 1880–1901), ser. 1, vol. 5:45 (hereafter cited as *OR,* all citations to ser. 1).

5. James A. Huston, "Logistical Support of Federal Armies in the Field," *Civil War History* 7 (March 1961): 39; Sears, *To the Gates of Richmond*, 39. Citing the official records, Huston states that transports had moved 110,000 men, 14,500 horses, and 44

batteries of artillery to the peninsula by April 6, but by July 1, the army reported 25,000 horses and mules present (even after suffering significant animal casualties), along with 3100 wagons and 350 ambulances. Ann Norton Greene states that McClellan's army used "46,000 animals: 34,000 draft horses, 6,850 artillery horses, and 5,000 cavalry horses" during the campaign. Huston, "Logistical Support of Federal Armies," 39–40; Ann Norton Greene, *Horses at Work: Harnessing Power in Industrial America* (Cambridge, Mass.: Harvard University Press, 2008), 145.

6. Sears, *To the Gates of Richmond*, 34–38; Kevin Dougherty, *The Peninsula Campaign: A Military Analysis* (Oxford: University Press of Mississippi, 2010), 62–63.

7. "Humid Continental Climate," *Encyclopedia Britannica*, last updated March 14, 2016, https://www.britannica.com/science/humid-continental-climate; John Weier, "El Niño's Extended Family," November 1999, http://earthobservatory.nasa.gov/Features/Oscillations/; "El Niño and La Niña," *Weather Almanac,* accessed October 21, 2014, http://www.weatherexplained.com/Vol-1/El-Ni-o-La-Ni-a.html; Celine Herweijer, Richard Seager, and Edward R. Cook, "North American Droughts of the Mid- to Late Nineteenth Century: A History Simulation and Implication for Mediaeval Drought," *Holocene* 16 (February 2006): 160–61.

8. Dougherty, *Peninsula Campaign,* 62–63, 72–73, 78.

9. Sears, *To the Gates of Richmond*, 35–39.

10. William J. Miller, "Weather Still Execrable: Climatological Notes on the Peninsula Campaign, March through August 1862, in *The Peninsula Campaign of 1862: Yorktown to the Seven Days,* 3 vols., ed. William J. Miller (Campbell, Calif.: Savas Publishing, 1997), 3:180–82; *Fighting for the Confederacy: The Personal Recollections of General Edward Porter Alexander,* ed. Gary Gallagher (Chapel Hill: University of North Carolina Press, 1989), 75.

11. Miller, "Weather Still Execrable," 180–82; Joseph E. Johnston to Robert E. Lee, April 22, 1862, *OR*, vol. 11, 3:456.

12. William J. Miller, "I Only Wait for the River: McClellan and His Engineers on the Chickahominy," in *The Richmond Campaign of 1862: The Peninsula and the Seven Days,* ed. Gary W. Gallagher, (Chapel Hill: University of North Carolina Press, 2000), 47–48; George B. McClellan to Winfield Scott, April 11, 1862, and McClellan to Ambrose Burnside, May 21, 1862, both in *The Civil War Papers of George B. McClellan: Selected Correspondence, 1860–1865,* ed. Stephen W. Sears (New York: Da Capo, 1992), 236, 269.

13. Roland Monette and Stewart Ware, "Early Forest Succession in the Virginia Coastal Plain," *Bulletin of the Torrey Botanical Club* 110 (January–March 1983): 80–86; Dougherty, *Peninsula Campaign,* 62–63; Sears, *To the Gates of Richmond,* 36.

14. Sears, *To the Gates of Richmond,* 18–25; Lafayette McLaws to "My dearly beloved wife," March 31, 1862, *A Soldier's General: The Civil War Letters of Major General Lafayette McLaws*, ed. John C. Oeffinger (Chapel Hill: University of North Carolina Press, 2002), 136–37.

15. Newspaper quoted in Miller, "Weather Still Execrable," 193–94.

16. Ibid., 192; Spencer Jones, "The Influence of Horse Supply upon Field Artillery in the American Civil War," *Journal of Military History* 74 (April 2010): 360–61.

17. April 6, May 4, 1862, diary entries, in Robert Knox Sneden, *Eye of the Storm: A Civil War Odyssey,* ed. Charles F. Bryan Jr. and Nelson D. Lankford (New York: Free Press, 2000), 40, 64; George B. McClellan to Edwin Stanton, May 5, 1862, in *Civil War Papers of George B. McClellan*, 255.

18. Gerald H. Johnson, *Geology of the Yorktown, Poquoson West, and Poquoson East Quadrangles, Virginia,* Report of Investigations 30 (Charlottesville: Virginia Division of Mineral Resources, 1972), 3–41, plate 1.

19. Ibid.; May 6, 1862, entry, *A Diary of Battle: The Personal Journals of Colonel Charles S. Wainwright, 1861–1865,* ed. Allan Nevins (New York: Harcourt, Brace & World, 1962), 58. The authors thank Cynthia Liutkus-Pierce, of Appalachian State University's Department of Geology, for helping us to understand the geologic history of the region and the nature of the different types of sedimentary layers.

20. McClellan to Winfield Scott, April 11, 1862, McClellan to Edwin Stanton, May 30, 1862, and McClellan to Ambrose Burnside, May 21, 1862, all in *Civil War Papers of McClellan*, 236, 281, 269; William J. Miller, comp., "The Grand Campaign: A Journal of Operations on the Peninsula, March 17–August 26, 1862," in *The Peninsula Campaign of 1862: From Yorktown to the Seven Days,* 3 vols., ed. William J. Miller (El Dorado Hills, Calif.: Savas Beattie, 2013), 1:180.

21. Union chaplain, Rev. Joseph Anderson, quoted in Steve Soper, *The "Glorious Old Third": A History of the Third Michigan Infantry, 1855 to 1927* ([Michigan]: Old Third Publishing, 1998–2007), 158; Confederate soldiers quoted in Yael A. Sternhell, *Routes of War: The World of Movement in the Confederate South* (Cambridge, Mass.: Harvard University Press, 2012), 59, 54.

22. For average Civil War soldier weight, see Matthew Philip Brennan, "The Civil War Diet" (MA thesis, Virginia Polytechnic Institute and State University, 2005), 38. For metabolic equivalent table (MET) expenditures, see "2011 Compendium of Physical Activities," *Compendium of Physical Activities,* accessed on March 12, 2018, https://sites.google.com/site/compendiumofphysicalactivities/Activity-Categories/walking. We determined that "marching rapidly, military, no pack" was a reasonably similar expenditure to marching through a viscous surface with a pack, equaling an 8 MET. Other possible exercises also suggest an 8 MET is appropriate. The authors thank Zachary Hottel (MA, Public History, 2015, Appalachian State University) for his assistance in determining the rate of energy expended, and Rebecca Battista, Department of Health, Leisure, and Exercise Science at Appalachian State University for explaining the Metabolic Rate of Energy.

23. McClellan to Ellen, May 6, 1862, *Civil War Papers of McClellan*, 257; May 6, 1862, entry, *Four Years in the Confederate Artillery: The Diary of Private Henry Robinson Berkeley,* ed. William H. Runge (Chapel Hill: University of North Carolina Press, 1961), 17.

24. Ludwell Lee Montague, "Subsistence of the Army of the Valley," *Military Affairs* 12 (October 1948): 227; Alfred Jay Bollet, *Civil War Medicine: Challenges and Triumphs* (Tucson, Ariz.: Galen Press, 2002), 338–39.

25. For instance, different cuts of beef average approximately 50 calories per ounce (or 1,000 calories per ration allowance), but much fattier bacon averages approximately

150 calories per ounce (or 1,800 calories per ration allowance). Similarly, flour—regardless of type—averages just under 100 calories per ounce (approximately 2100 calories per 1861 ration allowance), while cornmeal, regardless of variety, averages 90 calories per ounce (approximately 1800 calories per ration allowance). We used www.CalorieKing.com as the most reliable source for counting calories, but other similar calorie estimation sites deliver essentially the same numbers.

26. J. B. Polley to Nellie, May 19, 1862, in *A Soldier's Letters to Charming Nellie, By J. B. Polley of Hood's Texas Brigade,* ed. Richard B. McCaslin (Knoxville: University of Tennessee Press, 2008), 24; Wilbur Fisk to the Montpelier *Green Mountain Freeman,* April 24, June 7, 1862, *Hard Marching Every Day: The Civil War Letters of Private Wilbur Fisk, 1861–1865,* ed. Emil Rosenblatt and Ruth Rosenblatt (Lawrence: University Press of Kansas, 1992), 19, 32; Report of Surgeon Jonathan Letterman, March 1, 1863, *OR,* vol. 11, 1:214.

27. Kathryn Shively Meier, "'The Man Who Has Nothing to Lose': Environmental Impacts on Civil War Straggling in 1862 Virginia," in Drake, *The Blue, the Gray, and the Green*, 72; June 1862, entry, "Diary of Captain John H. Harris," in *Confederate Stamps, Old Letters, and History,* ed. Raynor Hubbell (Griffin, Ga.: n.p., n.d); Dietary Reference Intakes (DRI): Recommend Dietary Allowances and Adequate Intakes, Total Water and Macronutrients, accessed March 22, 2018, https://fnic.nal.usda.gov/fnic/interactiveDRI/results.php.

28. Johnson, *Geology of the Yorktown, Poquoson West, and Poquoson East Quadrangles*, 3–41; Browning, *Seven Days' Battles,* 25.

29. Miller, "I Only Wait for the River," 47–55.

30. Clifford Dowdey, *The Seven Days: The Emergence of Lee* (Boston: Little, Brown, 1964), 84–127.

31. Miller, "Weather Still Execrable,"185–86; McClellan to Mary Ellen, June 10, 1862, in *Civil War Papers of George B. McClellan*, 294; Robert E. Lee to Jefferson Davis, June 5, 1862, in *The Wartime Papers of Robert E. Lee,* ed. Clifford Dowdey and Louis H. Manarin (New York: Da Capo, 1961), 184.

32. Sears, *To the Gates of Richmond*, 345.

33. Paul E. Steiner, *Disease in the Civil War: Natural Biological Warfare in 1861–1865* (Springfield, Ill.: C. C. Thomas, 1968), 132–35; Bell, *Mosquito Soldiers,* 74.

34. Frank R. Freemon, *Gangrene and Glory: Medical Care during the American Civil War* (Madison, N.J.: Fairleigh Dickinson University Press, 1998), 205–6. Modern doctors prefer the term "enteric" over "typhoid" fever because *Salmonella paratyphi* is also a source of the disease. Here, we use "typhoid fever" as a generic descriptor to cover both diseases. Mayo Clinic Staff, "Diseases and Conditions: Typhoid Fever, Causes," Mayo Clinic Web site, accessed March 20, 2018, http://www.mayoclinic.org/diseases-conditions/typhoid-fever/basics/causes/con-20028553; Avelino Álvarez-Ordóñez et al., "Salmonella spp. Survival Strategies within the Host Gastrointestinal Tract," *Microbiology* 157 (2011): 3268–81.

35. Carville Earle, "Environment, Disease, and Mortality in Early Virginia," *Journal of Historical Geography* 5, no. 4 (1979): 370–72; Tadataka Yamada et. al., *Textbook of Gastroenterology*, 2 vols. (West Sussex, U.K.: Wiley, 2008), 2:1229.

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39. Wilbur Fisk to the Montpelier *Green Mountain Freeman*, Jan. 15, 1863, *Hard Marching Every Day*, 44; Meier, *Nature's Civil War*, 126–46.

40. Mary C. Gillet, *The Army Medical Department, 1818–1865* (Washington, D.C.: Center of Military History, 1987), 159; Report of Surgeon Jonathan Letterman, March 1, 1863, Report of Surgeon Charles S. Tripler, June 17, 1862, both in *OR,* vol. 11, 1:211, 207–10.

41. Report of Surgeon Jonathan Letterman, 214; June 29, 1862, entry in Sneden, *Eye of the* Storm, 82.

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44. McClellan to Mary Ellen, July 8, August 8, 1862, in *Civil War Papers of McClellan,* 346, 387.

45. Timothy Silver, *A New Face on the Countryside: Indians, Colonists, and Slaves in South Atlantic Forests, 1500–1800* (New York: Cambridge University Press, 1990),

155–61; Margaret Humphreys, *Malaria, Poverty, and Race in the United States* (Baltimore: Johns Hopkins University Press, 2001), 37; Bell, *Mosquito Soldiers,* 11; Glenna R. Schroeder-Lein, *The Encyclopedia of Civil War Medicine* (Armonk, N.Y.: M. E. Sharpe, 2008), 192–93.

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47. Humphreys, *Malaria, Poverty, and Race*, 37; Bell, *Mosquito Soldiers,* 74.

48. Sok Chul Hong, "The Burden of Early Exposure to Malaria in the United States, 1850–1860: Malnutrition and Immune Disorders," *Journal of Economic History* 67 (December 2007): 1001, 1002, 1011; McClellan to Mary Ellen McClellan, May 26, 1862, in *Civil War Papers of McClellan,* 277; Humphreys, *Malaria, Poverty, Race,* 37; "Table XXVIII: Abstract of the Sickness and Mortality of the Army of the Potomac," 174. Doctors characterized malaria as remittent, quotidian intermittent, tertian intermittent, quartan intermittent, and congestive intermittent fever.

49. Report of Surgeon Jonathan Letterman, 10–11; McClellan to Mary Ellen, July 11, 1862, in *Civil War Papers of McClellan,* 351.

50. "Table XXVIII," 174–79; Report of Surgeon Jonathan Letterman, 210–12; Keyes quoted in Andrew McIlwaine Bell, "'Gallinippers' and Glory: The Links between Mosquito-borne Disease and U.S. Civil War Operations and Strategy, 1862," *Journal of Military History* 74 (April 2010): 389.

51. Lisa M. Brady, "Nature as Friction: Integrating Clausewitz into Environmental Histories of the Civil War," in Drake, *Blue, The Gray, and the Green,* 146.

52. Ibid., 149; Brian Drake, "New Fields of Battle: Nature, Environmental History, and the Civil War," in Drake, *Blue, the Gray, and the Green*, 7; Paul Sutter, "The World with Us: The State of American Environmental History," *Journal of American History* 100 (June 2013): 94–119.

53. Miller, "Weather Still Execrable," 192.

54. Sharrer, *Kind of Fate,* 7–8; Steiner, *Disease in the Civil War*, 138–40.

55. For more on "hard war" policy, see Mark Grimsley, *The Hard Hand of War: Union Military Policy toward Southern Civilians, 1861–1865* (Cambridge: Cambridge University Press, 1995).