Introduction

Total War and American Nature

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SICILY, 1943: THE "MIGHT OF MATERIAL"

> When we send an expedition to Sicily, where does it begin? Well it begins at two places practically. It begins on the farms of *this* country, and in the mines of *this* country.
>
> – Franklin Roosevelt, July 1943[1]

In late summer 1943, famed war correspondent Ernie Pyle sat above a newly constructed port in Sicily – the island near Italy's toe that Anglo-American forces had invaded in early July – taking in the scene below. Pyle had sailed with Allied troops across the Mediterranean from North Africa. Before D-day in Normandy 11 months later, the Sicily campaign – Operation Husky – was the largest seaborne invasion in history, involving an astonishing armada of nearly 3,000 ships. "There is no way of conveying the enormous size of that fleet," wrote Pyle. "On the horizon it resembled a distant city. It covered half the skyline.. . . Even to be part of it was frightening."[2]

Those ships delivered 180,000 soldiers onshore but also 14,000 vehicles, 600 tanks, and 1,800 large guns – half of this huge quantity during the attack's first 48 hours. Many landing craft carried not people but supplies; 20 carried water alone.[3] In subsequent days, other supplies

[1] A. J. Baime, *The Arsenal of Democracy: FDR, Detroit, and an Epic Quest to Arm an America at War* (Boston: Houghton Mifflin Harcourt, 2014), 210.
[2] Ernie Pyle, *Brave Men* (New York: H. Holt and Co., 1944), 8.
[3] James Dunn, "Engineers in Sicily," in *Builders and Fighters: US Army Engineers in World War II*, ed. Barry W. Fowle (Fort Belvoir, VA: Office of History, US Army Corp of Engineers, 1992), 408.

FIGURE I.1 LST carrying innumerable supplies for the US military, Invasion of Cape Gloucester, New Britain, December 24, 1943. Records of the US Coast Guard; Activities, Facilities, Personalities, 1785–1967, Record Group 26, National Archives and Records Administration (NARA), Image 513188.
Source: Image in the public domain

would follow: food, fuel, ammunition, spare parts, medicine, maps, cigarettes, tents, radios and telephones, and much, much more – everything that a modern army needed, and modern armies needed a great deal. "We kept pouring men and machines into Sicily," Ernie Pyle observed, "as though it were a giant hopper" (see Figure I.1).[4]

American abundance of natural resources, and the ability to mobilize and focus them, gave the Allied soldiers, sailors, and airmen a tremendous advantage everywhere they fought. Each US soldier in the field was backed by roughly 67 pounds of equipment and supplies.[5] "When an American soldier goes over from here," President Roosevelt emphasized to the press corps a few weeks after the Sicily invasion begun, "he is fully equipped, not only his clothing, but also all of the munitions that are assigned to him, which include almost everything – guns, rifles, machine

[4] Pyle, *Brave Men*, 24.
[5] Daniel Yergin, *The Prize: The Epic Quest for Oil, Money, and Power* (New York: Free Press, 2003), 382. In the Pacific each American soldier was supported by four tons of supplies but each Japanese soldier by only two pounds. Richard Overy, *Why the Allies Won* (New York: W. W. Norton, 1995), 210.

guns and ammunition, artillery small and large, tanks, planes, trucks, and everything else."[6]

"Everything else" included powerful tools that also gave the Allies a great advantage: vast amounts of oil and gas, far more than in any previous war; huge quantities of food, packaged for easy storage and delivery and designed to last for months; detailed maps of Sicily's rugged terrain, drawn from the aerial photographs that had become essential before any battle; boxes and boxes of cigarettes, provided by the military in generous quantities for tired and nervous troops; medicines like antibiotics, newly developed and available in large quantities; and chemicals such as DDT, a newly synthesized substance that helped prevent a typhus outbreak among troops and civilians in mainland Italy the next year. Watching the varied supplies pile higher and higher on Sicily's shores, Pyle had an epiphany: "Suddenly I realized what all this was. It was America's long-awaited power of production finally rolling into the far places where it had to go."[7]

That power of production proved decisive. In 1943, US productive capacity began to tip the tide in favor of the Allies. "To a large degree, the improvement in the military situation [in 1943]," historians Robert Coakley and Richard Leighton have written, "was a result of the huge outpouring of munitions from American factories and of ships from American yards."[8]

World War II was a war of hundreds of thousands of guns, tanks, and planes, and thousands of other products. One prominent historian has called it a "gross national product war."[9] As such, it was also a war of mines, farms, and factories – largely industrial or industrializing sites where slices of nature were extracted and processed into military machines and materiel.

[6] Franklin D. Roosevelt: "Excerpts from the Press Conference," July 27, 1943. Online by Gerhard Peters and John T. Woolley, *The American Presidency Project*, www.presidency.ucsb.edu/documents/excerpts-from-the-press-conference-14 (accessed October 23, 2018).

[7] Pyle, *Brave Men*, 25.

[8] Robert W. Coakley and Richard M. Leighton, *Global Logistics and Strategy: 1943–1945* (Washington, DC: US Government Printing Office, 1955), 601, quoted in Doris Kearns Goodwin, *No Ordinary Time: Franklin and Eleanor Roosevelt and the Home Front in World War II* (New York: Simon & Schuster, 2013), 450.

[9] Russell Weigley, *The American Way of War: A History of United States Military Strategy and Policy* (New York: MacMillan, 1973), 146. Indeed, the concept of the gross national product (GNP) was developed in 1942 by economists to determine whether the United States had the productive capacity to meet the needs of the nation's World War II Victory Program. Jim Lacey, *Keep from All Thoughtful Men: How US Economists Won World War II* (Annapolis, MD: Naval Institute Press, 2011), 45.

Nothing showed the Allies' dependence on American productive landscapes better than the "fireside" chat that Franklin Delano Roosevelt gave on July 28, 1943, two and a half weeks after the first soldiers splashed ashore on Sicily's beaches. As they sat in living rooms by their radios, Americans listened as President Roosevelt explained the import of Sicily. "I think the first crack in the Axis has come," Roosevelt announced with signature mix of gravity and optimism. "The criminal, corrupt Fascist regime in Italy is going to pieces."

But the job was far from done and still uncertain, the president stressed. Ultimate success, he emphasized, depended on what happened not in Europe but thousands of miles away: on the American home front that produced the weapons and other supplies that Allied soldiers carried with them. American power, Roosevelt said, came from America's farms and mines, its natural resources and productive capacity:

> Behind the invasion forces ... were thousands of ships and planes guarding the long, perilous sea lanes, carrying the men, carrying the equipment and the supplies to the point of attack. And behind all these were the railroad lines and the highways here back home that carried the men and the munitions to the ports of embarkation – there were the factories and the mines and the farms here back home that turned out the materials – there were the training camps here back home where the men learned how to perform the strange and difficult and dangerous tasks which were to meet them on the beaches and in the deserts and in the mountains.[10]

FDR's words help us see what distinguished World War II from earlier conflicts. The Allied invasion force included not just an army of soldiers and sailors but an army of supplies and equipment of unprecedented scale and scope. Watching these supplies move ashore in Sicily, Pyle spoke of "the might of material."[11] All these materials – each soldier, ship, and plane – relied upon transportation networks, fuel, factories, mines, and farms. The war, Roosevelt was saying, demanded not just amassing a large military force but drawing together critical materials from all possible sources, near and far, and concentrating them into one enormous, mobile, lethal force. It was indeed a GNP war, a war of total mobilization.[12]

[10] Franklin D. Roosevelt, "Fireside Chat 25: On the Fall of Mussolini" (speech, Washington, DC, July 28, 1943) UVA Miller Centre, https://millercenter.org/the-presidency/presidential-speeches/july-28-1943-fireside-chat-25-fall-mussolini (accessed October 6, 2018).

[11] Pyle, *Brave Men*, 25.

[12] Paul Kennedy expands on this theme. "Gigantic productive power means little in wartime unless it is harnessed and its resources are directed to the right places. Total steel output means nothing at all until it is directed toward well-designed Essex class carriers.

Wars can be understood many ways – politically, strategically, economically, socially, personally. They also can be understood environmentally. Geography and supplies shape strategy and outcomes, and battles remake coastlines, fields, and forests. Less well known is how, even far from the battle zones, the need for supplies militarize landscapes and remake ecosystems.

No war transformed natural environments more than World War II – a total, global conflict that saw massive fighting across four continents and four oceans and drew resources from around the planet. The discussion of "total war" – the state's capacity to mobilize nearly all human and natural resources for the military effort – has rarely engaged its underlying environmental preconditions, even though total war entails massive and even transformative interventions into natural systems. More than any previous war, World War II achieved this total mobilization of resources across the world. The United States played a decisive role in the war and the story of its astoundingly rapid accumulation of military capacity is well known. Yet, surprisingly, historians have hardly explored the environmental dimensions of the American home-front transformation.

This volume examines the environmental aspects of the war, not in far off battlefields but on and near US soil, often with long-term consequences that linger even today. We investigate these matters by pursuing the clues provided by FDR's Fireside Chat on the home front. We look at the transportation networks that made World War II into a "war of transportation," the mines that yielded "strategic" minerals, the farms that transformed soil and seed into fiber and nutrition, the factories that forged the guns and munitions, and the training camps that molded skilled fighters and new methods. The location, abundance, and quality of these resources – shaped by new technologies and new logistical strategies – created the "might of material" that transformed the United States into the Arsenal of Democracy. American geology, hydrology, geography, and biology all mattered. Minerals, coastlines, rivers and wetlands, forests, and atmospheres, as well as farmlands, cities, and other human-built environments, shaped the war and were deeply transformed by it.

Aluminum and rubber and copper mean nothing until they are given to the B-29 construction program. Skilled workers mean nothing until Ben Moreell [of the Seabees] organizes them." Paul M. Kennedy, *Engineers of Victory: The Problem Solvers Who Turned the Tide in the Second World War* (Toronto: HarperCollins Publishers, 2013), 351. "Sheer numbers were not enough." Ibid., 363.

What made large and lethal American fighting forces in Europe and the Far East possible was a marshaling of material resources – physical objects and energy – drawn from forests, waterways, and soils around the United States and, indeed, around the world. Organizing these resources required new organizational tools and methods, and left behind a legacy of transformed landscapes, powerful new technological tools, and ideas about nature that would shape American relations with nature for decades to come.

In 1938, before massive wartime spending began, most Americans lived in small towns, farms, or small urban areas; traveled by rail; and had never heard of penicillin, DDT, or atomic bombs. By 1945, the scales had tipped decidedly toward military-industrial urban areas, the Sunbelt, machine and chemical agriculture, air travel, oil-based materials, such as nylon, and a Keynesian "growth" economy stressing government-sponsored consumption. The war spurred in the United States a vastly expanded production capacity and powerful new economic tools: a new military-industrial geography and transformed sense of time and space; new "miracle" technologies and a new material culture; new forms and quantities of waste and pollution; and new ideas about nature's fragility. In sum, the war forged the world we live in – not just the political and economic order but also the built environment, material culture, and intellectual topography, not to mention American landscapes near and far.

Understanding the environmental dimensions of the war provides a novel, penetrating way to understand not just World War II – the most crucial of all events in recent American history – but its lasting impact on American society.

ENVIRONMENTAL TRANSFORMATIONS IN THE UNITED STATES DURING WORLD WAR II

> If the Second World War touched every portion of the outside world, its domestic impact reached into every corner of the United States as well.
> Historian Roger Lotchin[13]

Before the mid-nineteenth century, preindustrial warfare had created only limited, local impact on natural environments. The environmental

[13] Roger Lotchin, "Turning the Good War Bad?," *Journal of Urban History* 33, no. 2 (2007): 175.

impacts of warfare in medieval Europe, for instance, were small-scale and limited, resulting from sieges of fortified castles and towns, the cutting of selected species of trees (such as Yew trees for longbows), disruption of watercourses, and scorched earth campaigns, or *chevauchées*, designed to deprive populations of essential food and supplies.[14] Armaments were limited in destructive power, military transport systems were still largely limited to human marching and horseback, and environments usually recovered quickly from the effects of war.

Industrial wars in the nineteenth century, especially the American Civil War, changed all that permanently. The Civil War was a transitional war, exhibiting both traditional dimensions and the new power of industrial systems, foreshadowing what was to come.[15] Bringing together huge armies for several years of warfare and introducing factory production and rail transport, the Civil War both shaped and was shaped by nature. The North-South conflict shows many of the main concerns of environmental historians of war: the impact of battlefields on war and war on battlefields; changing forms of resource consumption and energy use; the overlap of health, disease, and warfare; new forms of governmental planning; and changing ideas of nature.

Fifty years later, World War I showed how interlinked war and nature had become in the industrial age and highlights the tremendous transformative power of national security imperatives not just on human systems but also on ecologies, hydrologies, and geologies. Nature factored into World War I in many of the same ways it did with the Civil War – through strategy, battlefield destruction, resource mobilization, disease landscapes, and state planning. Of these, the United States was, at first, initially mostly involved with resource mobilization, supplying England,

[14] Richard C. Hoffmann, *An Environmental History of Medieval Europe* (Cambridge: Cambridge University Press, 2014); Bruce M. S. Campbell, *The Great Transition: Climate, Disease and Society in the Late Medieval World* (Cambridge: Cambridge University Press, 2016).

[15] 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, "Gettysburg and the Organic Nature of the American Civil War," in Richard P. Tucker and Edmund Russell, *Natural Enemy, Natural Ally: Toward an Environmental History of Warfare* (Corvallis: Oregon State University Press, 2004), 93–109; Megan Kate Nelson, *Ruin Nation: Destruction and the American Civil War* (Athens: University of Georgia Press, 2012); Kathryn Shively Meier, *Nature's Civil War: Common Soldiers and the Environment in 1862 Virginia* (Chapel Hill: University of North Carolina Press, 2013); 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).

France, and others with food, industrial equipment, horses, and more.[16] Factories and fields rapidly increased the production of steel and copper, timber, grain, rubber, and petroleum.[17] New productive technologies yielded new forms of pollution.

During the Great War, to coordinate government-industry relations and allocate resources, the US federal government created a series of regulatory agencies, centered on the War Industries Board, which brought together federal officials and heads of the major industrial corporations. The military-industrial complex began to take shape. But traditional opposition to a powerful federal government was still widespread, so most of those agencies were dismantled quickly after November 1918, and the US military downsized once again.[18] The aftermath of World War II would be very different.

Expanding and institutionalizing many of the developments of the Civil War and World War I, World War II played a transformative role in creating the world we live in today – its built environment, material culture, and intellectual geography, as well as American landscapes around the country.

This book's chapters explore the rise of the two most important factors shaping environmental change during the second half of the century: national security concerns and a related technology-driven growth economy. We see the emergence of the military-industrial political economy, the birth of "big science" and the modern university; techno-optimism; the consolidation of corporate agriculture and the industrial food system; the coming of age of West Coast cities, such as Seattle and Los Angeles; the profound remaking of Detroit, Birmingham, New Orleans, and indeed, of much of urban America; and, finally, the demographic shifts that define America today – the rural to urban

[16] Tait Keller, "Mobilizing Nature for the First World War: An Introduction," in *Environmental Histories of the First World War*, ed. Richard P. Tucker, Tait Keller, J. R. McNeill, and Martin Schmid (Cambridge: Cambridge University Press, 2018), 1–16; Paul A. C. Koistinen, *Mobilizing for Modern War: The Political Economy of American Warfare, 1865–1919* (Lawrence: University Press of Kansas, 1997).

[17] Richard P. Tucker, "War and the Environment," in *At War: The Military and American Culture in the Twentieth Century and Beyond*, ed. David Kieran and Edwin A. Martini (New Brunswick, NJ: Rutgers University Press, 2018), 240–257.

[18] Roger Chickering and Stig Förster, eds., *The Shadows of Total War: Europe, East Asia, and the United States, 1919–1939* (Cambridge: Cambridge University Press, 2003); Williamson Murray and Allan R. Millett, eds., *Military Innovation in the Interwar Period* (Cambridge: Cambridge University Press, 1996); Joseph Maiolo, *Cry Havoc: How the Arms Race Drove the World to War, 1931–1941* (New York: Basic Books, 2010).

shift, the Great Migration of African Americans to urban and western cities, and the general shift to the Sunbelt. Nature played a role in, and was shaped by, all these changes.

Most noticeably, the war years produced, in the words of economic historian Robert Gordon, an "economic miracle."[19] Factory floor space and productivity shot upward. From 1942 to 1945, ship building times dropped by 67 percent. Steel production grew from 67 million tons per year in 1940 to 89 million tons in 1944, even as the number of workers remained constant – the change owing entirely to productivity gains. Overall, between 1940 and 1945, productivity per worker-hour climbed by 21 percent. Plant capacity grew as well. By 1945, the United States had 50 percent more productive capacity than in 1940.[20] These gains – along with the devastation of much of the rest of the industrial world – jumpstarted America's postwar economy. "Every part of the postwar manufacturing sector had been deeply involved in making military equipment or its components," Gordon notes, "and the lessons learned from the war translated into permanent efficiency gains after the war."[21] The early 1940s saw America's Keynes-inspired growth-based "guns and butter" economy – the modern economic approach that would drive postwar prosperity and environmental transformation – take shape.

The American military juggernaut mobilized resources on an unprecedented scale and with new planning and technological power from all over the United States and, indeed, all over the world. In 1945, a government report evocatively described the material needs of modern warfare. Echoing FDR's 1943 home-front speech, it described the transformations to forests, fields, rivers, and streams that made it possible:

> War is indeed a story of arms and men; of supplies as well as soldiers. An army cannot fight a modern war with naked fists; front lines are unavoidably inhered to supply lines. And these supply lines reach all the way back along "red ball" truck lines [in Europe's western front], rails, and the bridge of ships to the ordnance plants, shipyards and plane assembly plants; to factories making bearings, gears, radio tubes, and thousands of other components; to petroleum wells and refineries producing the power for bombers and fighters, trucks and jeeps; to copper, iron, lead, zinc, and coal mines; to farms and forests. The story of the battle of supply is

[19] Robert J. Gordon, *The Rise and Fall of American Growth: The US Standard of Living since the Civil War* (Princeton, NJ: Princeton University Press, 2016), 537.
[20] D'ann Campbell and Richard Jensen, "Domestic Life, War Effort, and Economy," in *The Oxford Companion to World War II* (Oxford: Oxford University Press, 2001), 1180–1182.
[21] Gordon, *The Rise and Fall of American Growth*, 550.

the story of the production of all the raw materials and components, of all the assembly processes, and of all the management skill and labor that go into the making of a modern war machine.[22]

Because of the modern military machine – and the new production, new assembly processes, and new management skills that comprised it – "the demands on resources," as the Interior Department noted a few years later, "had become permanently higher."[23] Nothing shows this new productive efficiency's impact on resources better than wartime forestry. The nation's forests felt the pressure of war, as the federal Forest Service worked closely with the military to maximize war production, often by clearcutting entire stands of trees. Efficient collaboration expanded the timber products industry's technological, organizational, and financial capacity to penetrate further and more efficiently into both previously managed and previously untouched forest zones. New equipment was designed and new logging roads were bulldozed.[24] In this and other industries, the war expanded productive capacity exponentially; this new capacity would alter landscapes for decades to come.

The change was not just quantitative but also qualitative. Many of the technologies that drove America's productivity jump manipulated nature in unprecedented ways and with new intensity, ushering in unintended and previously unknown environmental consequences. David Lilienthal, writing in 1944, noted the wartime "machines of wizardry" that were spinning out "the stuff of a way of life new to this world."[25] Because of the length of the war, the tremendous innovations of previous decades, and the new determination with which governments mobilized these innovations and pursued others, scores of new technologies emerged during and immediately after the war – some decades in the making and applied with new wartime urgency, and others newly developed by scientists commissioned by the military. These technologies were unlike anything the world had ever seen. Taken together they entailed vast new human powers to alter the earth.

[22] US War Production Board, *War Production in 1944* (Washington, DC: Government Printing Office, 1945), 25.
[23] Department of Interior, *Years of Progress, 1945–1952* (Washington, DC: Government Printing Office, 1953), 3.
[24] Richard P. Tucker, "The World Wars and the Globalization of Timber Cutting," in *Natural Enemy, Natural Ally: Toward an Environmental History of* War, ed. Richard P. Tucker and Edmund Russell (Corvallis: Oregon State University Press, 2004), 110–141.
[25] David Lilienthal, *TVA: Democracy on the March* (New York: Harper & Brothers, 1944), 3.