Environments of War: The Pacific Northwest and the Waging of World War II

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ENVIRONMENTS OF WAR:
THE PACIFIC NORTHWEST AND THE WAGING OF WORLD WAR II

A DISSERTATION SUBMITTED TO
THE FAULTY OF THE GRADUATE SCHOOL
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

PROGRAM IN HISTORY

BY

KATHERINE MACICA

CHICAGO, IL
AUGUST 2023
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For my grandparents
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<tr>
<td>ASLP</td>
<td>Alaska Spruce Log Program</td>
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<td>AAC</td>
<td>Army Air Corps</td>
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<tr>
<td>AAF</td>
<td>Army Air Force</td>
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<tr>
<td>BPA</td>
<td>Bonneville Power Administration</td>
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<td>DPC</td>
<td>Defense Plant Corporation</td>
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<td>HEW</td>
<td>Hanford Engineer Works</td>
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<td>NPS</td>
<td>National Park Service</td>
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<td>NRPB</td>
<td>National Resources Planning Board</td>
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<tr>
<td>OPM</td>
<td>Office of Production Management</td>
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<tr>
<td>OSC</td>
<td>Oregon Shipbuilding Corporation</td>
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<tr>
<td>PWA</td>
<td>Public Works Administration</td>
</tr>
<tr>
<td>STSC</td>
<td>Seattle-Tacoma Shipbuilding Corporation</td>
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<tr>
<td>USFS</td>
<td>United States Forest Service</td>
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<tr>
<td>WMC</td>
<td>War Manpower Commission</td>
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ABSTRACT

The Pacific Northwest served an essential role in America’s “Arsenal of Democracy.” Weapons and material produced in the Northwest proved essential to the Allied victory in World War II. These weapons served as agents of destruction abroad, but became agents of transformation for the places in which they were produced. This dissertation examines four of the most important resources and industries in Oregon and Washington to emerge or expand as a result of the war: hydroelectric power, forest products, shipbuilding, and aircraft manufacture. The wartime development of these industries profoundly reshaped the physical and economic landscape of the Pacific Northwest, leading to more intensive use of the region’s natural resources, diversification of the region’s economy, and closer ties to the federal government. Although the direct combat of the war took place far from the Pacific Northwest, the war unleashed transformative powers within the region, precipitating changes that reshaped the region and continue to affect residents and their environments today.
INTRODUCTION

The Pacific Northwest served an essential role in America’s “Arsenal of Democracy.” Weapons and material produced in the Pacific Northwest were vital to the Allied victory in World War II. Lumber cut and milled in Washington and Oregon proved integral to logistical warfare, enabling war materiel to be transported to battlefronts around the world. Shipyards in the Northwest built and repaired more than four thousand vessels of all sizes and functions for Allied forces. Battleships, destroyers, escort aircraft carriers, and auxiliary vessels waged war at sea, while merchant vessels brought supplies and equipment to battlefields in Europe and the Pacific. Thousands of B-17 heavy bombers rolled out of Boeing’s Seattle-area factories during the war, providing the backbone of the Allies’ daylight strategic bombing campaign in Europe. In the Pacific, Boeing’s bombers provided the initial defense of America’s island possessions and later, with the introduction of the longer-range B-29, contributed to the island-hopping campaigns, bringing the war directly to Japan. In a secret facility in the desert of eastern Washington, workers produced plutonium to power the world’s first atomic bomb test and the bomb dropped on Nagasaki to end the war. The region’s two enormous hydroelectric dams spanning the Columbia River produced the electricity necessary to power these massive new industrial facilities, as well as to irrigate thousands of acres of land for crop production.¹ These

¹ Carlos A. Schwantes, The Pacific Northwest: An Interpretive History, rev. ed. (Lincoln: University of Nebraska Press, 1996), 411; An Industrial and Administrative History of the Puget Sound Navy Yard, 1891-1945; Box 5; 13th Naval District, Commandant’s Office; 13ND-5: Wartime Unit Histories; Records of Navy Installations Command, Navy Regions, Naval Districts, and Shore Establishments, Record Group 181 (RG 181), National Archives at Seattle, Washington (NARA Seattle); Wartime History of the Supervisor of Shipbuilding, United States Navy, Seattle, Washington; Box 6; 13ND-5: Wartime Unit Histories; RG 181; NARA-Seattle; World War II History of the Supervisor of Shipbuilding, USN, Portland, Oregon, Box 6; 13ND-5: Wartime Unit Histories; RG 181; NARA-Seattle.
weapons and materiel produced in the Northwest made critical contributions to the prosecution of the war and transformed environments around the world through their use in battle.

At the same time, the weapons, which became agents of destruction abroad, served as agents of destruction as well as transformation for the places in which they were produced. This dissertation examines four of the most important resources and industries in Oregon and Washington to emerge or expand as a result of the war: hydroelectric power, forest products, shipbuilding, and aircraft manufacture. The wartime development of these industries profoundly reshaped the physical and economic landscape of the Pacific Northwest, leading to more intensive use of the region’s natural resources, diversification of the region’s economy, and closer ties to the federal government. Although the direct combat of the war took place far from the Pacific Northwest, the war unleashed transformative powers within the region, precipitating changes that reshaped the region and continue to affect residents and their environments today. The wartime transformations in the region fall into three primary categories: environmental, economic, and organizational.

First, the development of war industries in the Pacific Northwest led to more intensive use of the region’s natural resources. The major industries examined in this dissertation were situated in the Northwest for a variety of strategic reasons, but access to the region’s resources represented a primary factor. Washington and Oregon’s waterways, forests, available land, population, and climate were among the key resources abundant in the Northwest and sought by war industries. Each industry used local resources differently, with myriad results for the environment. Through the process of war mobilization, these industries militarized the region’s landscape, turning Northwest environments into sites of war.
The war generally proved destructive of the Northwest’s natural resources, except where the public had already come to value the resource intact and where protections were already in place. Waterways in urban areas, such as Puget Sound and the Duwamish, Willamette, and Columbia Rivers, generally were understood as part of the region’s urban industrial infrastructure, not as elements of nature to be protected from pollution or other forms of exploitation. Those waterways became industrial sinks for the waste of the growing war industries in the Seattle-Tacoma and Portland metropolitan areas. Likewise, the region’s forests sustained more extensive harvesting. Limitations to the exploitation of forest resources depended upon forest ownership, demand for certain species, composition of the forest, and available manpower and technology.

War production militarized the Northwest’s landscape and waterways. It spurred industrialization, urbanization, and development throughout the region. Cities and rural areas became sites of war as factories and military cantonments expanded throughout the region. Industries sought the latent resources of Northwest cities to expand war production, leading to the growth of industrial infrastructure and population in the region’s metropolitan areas. Hydroelectric power became a weapon as it powered the growing war machine in the Northwest. The Columbia and Willamette Rivers and Puget Sound served as major transportation routes for naval and merchant vessels deploying overseas, as well as for transporting raw materials to the cities to be remade into weapons of war.

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Second, the war transformed the region’s economy, diversifying its economic base and creating new networks of capital, commodities, and resources. Prior to the war, the Northwest economy was largely colonial: resources were extracted and transported east for manufacturing, and manufactured products were imported into the region from elsewhere. The Northwest suffered from a lack of economic imagination, both within the region and in the larger national context. Because of its wealth of natural resources, particularly forest products, and geographic location distant from traditional centers of manufacturing in the Midwest and East Coast, economists and planners believed the region could only serve as a supplier of materials to established industrial cities. The war emergency forced economists, planners, and policymakers to rethink the potential of the Northwest. The need to procure war materiel as quickly as possible and in large quantities encouraged a reimagining of the possibilities of using the region’s resources in novel ways. Instead of seeing the drawbacks of the Northwest as an isolated place far from established industrial infrastructure, planners, industrialists, and the military saw advantages in the region’s deep water ports, mild climate, hydroelectric power generating capacity, proximity to raw materials, and urban centers with concentrations of workers.

The military and industrialists took advantage of these characteristics, spurring the growth of shipbuilding, aircraft manufacturing, aluminum, and lumber industries in Northwest cities. The growth of these industries also led to the expansion of ancillary industries that made parts and subassemblies for the larger products. Through war production, the Northwest expanded its

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4 William Robbins has written extensively about the relationship between the economy and environment of the Pacific Northwest. For a succinct overview of the argument that the West was a colony of the East, see William G. Robbins, *Colony and Empire: The Capitalist Transformation of the American West* (Lawrence: University Press of Kansas, 1994).

economic base beyond extractive industries to diversified manufacturing. Military contracts brought new flows of capital between Washington, DC and the Northwest. Northwest businesses received billions of dollars’ worth of contracts during the war, and many of those businesses, most prominently Boeing, continued as key military contractors into the postwar era.\(^6\)

Manufacturing and deploying weapons of war in the Northwest led to new flows of commodities and resources into and out of the region. Where prior to the war, the region primarily exported lumber, as a result of the war, materials like bauxite, steel, and aircraft engines were imported into the region, and products like advanced heavy bombers, ships of all sizes and varieties, and engineered wood products were exported from the region to battlefields around the world.

Finally, the war transformed the relationship between the Pacific Northwest and the federal government, engendering closer ties between the region and the government. The federal government maintained a significant presence in the Northwest prior to the war. Through various New Deal programs, the federal government invested nearly $1 billion in Washington and Oregon between 1933 and 1939, the ninth and eleventh highest rate of expenditure per capita, respectively.\(^7\) In addition, federal agencies under the Department of Agriculture and the Department of the Interior owned a significant amount of land in the Northwest. The war expanded these economic and material connections, both quantitatively and qualitatively.

War production spurred new flows of capital between the federal government and the region, as Northwest manufacturers secured billions of dollars’ worth of contracts for the production of war materiel. The wartime contracts became the basis for a military-industrial

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complex in the region that continues today. The war also expanded the physical presence of the federal government in the Northwest. Mobilization required the expansion of existing military cantonments, as well as the temporary or permanent acquisition of land for new sites for military use throughout the region. Although some of those facilities reverted to private ownership and use after the war, the government retained control over more Northwest land after the war than it had before. The government also funded the construction of infrastructure throughout the region, including industrial and residential structures, that continued to benefit local residents long after the war ended.

Warfare is one of the most unpredictable agents of change for societies and environments. For sites of combat, war proves extremely destructive. Fallout from the physical, political, economic, cultural, and psychological effects of war can last for generations. At the same time, war can also unleash a type of creative destruction. People can use the devastation to rebuild better cities and societies in place of what was lost. In locations far from the battlefield, people can attempt to control the destructive/creative forces of war in order to shape the expected outcomes to their advantage. In this way, mobilization for war becomes

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9 It is difficult to determine an exact figure for federal land ownership. Indeed even today, the Congressional Research Service admits that the “total federal land in the United States is not definitively known.” US Library of Congress, Congressional Research Service, *Federal Land Ownership: Overview and Data*, by Carol Hardy Vincent and Laura A. Hanson, R42346, (updated February 21, 2020), 1. For the purposes of this study, I use the methodology of the Congressional Research Service by estimating the holdings of the largest land-owning agencies in the Northwest at the time: Forest Service, various agencies of the Department of the Interior, Department of War and Department of the Navy.

opportunity. But the unpredictable nature of war remains.\textsuperscript{11} As much as federal, state, and local actors sought to control the outcomes of war in the Pacific Northwest, it nonetheless unfolded in unforeseen ways with unintended consequences, leaving the region looking much different by 1945 than they would have imagined in the 1930s.

Figure 1. Industrial Map of the State of Washington, 1945. Office of the Secretary of State of Washington, Washington State Archives.

This dissertation brings environmental, military, and Western history into conversation with each other to examine the impact of World War II in the Pacific Northwest. Each of these fields has a rich body of literature which provides the foundation for the present study. However, significant gaps exist in the historiography which leave the effects of the war on the environment

\textsuperscript{11} Laakkonen et al., \textit{The Resilient City in World War II}, 6-8; Mark Wilson, \textit{Destructive Creation: American Business and the Winning of World War II} (Philadelphia: University of Pennsylvania Press, 2016), 10.
of the Pacific Northwest largely unexamined. The importance of the environment to warfare has
long been studied by tacticians and military historians, but the literature generally tends to
overlook the reverse relationship. Environmental historians have only recently begun to consider
the repercussions of warfare on the non-human world. Historians of the American West have
examined various aspects of the war, both on a larger regional scale and in smaller case studies,
but the effects of war for the Northwest remain underexplored. Using these three fields as its
foundation, this project takes a new approach to the study of World War II, drawing connections
between warfare and the environment in a place profoundly affected by the conflict but generally
overlooked by historians.

Historical analysis of the events of World War II began during the war. In 1942,
President Roosevelt requested that the government agencies involved in the war effort prepare
historical accounts of their wartime activities. Over the next three decades, staff and contract
historians from the Army, Navy, Marine Corps, and Air Force historical divisions prepared
dozens of works detailing the operations of activities of their respective branches of the military
during the war. These official histories provide an exhaustive reference for historians, serving

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12 Wesley F. Craven and James Lea Cate, eds., *The Army Air Forces in World War II*, vol. 1, *Plans and Early

13 The Air Force produced a seven-volume history of its wartime activities between 1948 and 1958. The Army’s
Historical Division has published more than seventy volumes on the Army’s role during the war since the project
was approved in 1946. Richard D. Adamczyk and Morris J. MacGregor, *United States Army in World War II:
Historical Section produced fifteen monographs on specific topics, beginning with Lt. Col. Robert D. Heinl, Jr., *The
Defense of Wake* (Washington, DC: Historical Section, Division of Public Information, Headquarters, US Marine
Corps, 1947). After that, between 1958 and 1971, the Marine Corps published a five-volume overview of the Marine
vol. 1, Pearl Harbor to Guadalcanal* (Washington, DC: Historical Branch, G-3 Division, Headquarters, US Marine
Corps, 1958), iv–vi. The Navy also produced a multi-volume history of its activities during the war, but contracted
with Harvard historian Samuel Eliot Morison beginning in 1942 to research and write the works. Thus the Navy did
not view these as “an official history.” Samuel Eliot Morison, *History of United States Naval Operations in World
and Company, 1990), ix.
as the starting point for investigating preparations for and the execution of the war. Military history literature has built upon this foundation and grown to encompass a vast array of studies of the war, from histories that detail particular military campaigns, to histories of the process of economic and industrial mobilization, and studies that examine the experiences of soldiers at war.14

However vast the body of literature on World War II, nonetheless several key areas receive little attention. Military histories of the war largely foster a disconnect between the battlefield and the home front. Works discuss either one or the other and rarely examine the relationships between sites of battle and the places in which nations produced war materiel and mobilized their forces.15 Similarly, aside from the official histories produced by the Army, Navy, and Air Force, few works have explored the material aspects of war production. What materials and processes were used in the manufacture of weapons such as aircraft and naval vessels? Where did construction take place and why? Certainly a great many works offer detailed views inside the mechanics and use of particular weapons. While many of these books serve as

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excellent reference guides to understand the material culture of the weapon, they often fall short in situating the individual items within the larger historical context. Finally, military historians tend to view the environment as a setting on which battles take place, or as the source of strategic resources to be controlled. The aftermath of warfare on the landscape receives little attention, despite the very visible effects. These connections are fertile and important grounds for study, as they reveal the ways in which warfare transforms locations far from the battlefield.

Environmental historians have only recently begun to turn their attention to the impacts of militarization and warfare on the environment. When environmental history emerged as a distinct field in the 1960s and 1970s, environmental historians tended to focus on the political and intellectual history of conservation and the environmental movement. Studies expanded the scope of the field in the next decade to explore the material consequences of the relationship between humans and the non-human world. These works primarily focused on wilderness or rural spaces as the subject of inquiry. As the field grew in the last decades of the twentieth

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century, it took both an urban and cultural turn.\textsuperscript{20} By the turn of the twenty-first century, environmental history was an expansive field, but a few areas remained unexplored, particularly the environmental impacts of war. Indeed, in a 2003 historiographical essay John McNeill asserted that, “at no point in the evolution of American environmental history has anyone seen fit to recognize the prominence of the military in American life since 1941, and its significance in shaping American environments.”\textsuperscript{21} Over the next several years, studies appeared that began to fill this gap in the historiography.

Innovations in understanding the effects of warfare on the environment have come from the emerging subfield of war and environment studies within environmental history. Edited volumes laid the foundation and set the direction for the scholarship in this field, pointing the way toward new areas of study, revealing gaps in the literature, and demonstrating methods and theory for future scholarship to utilize. Among the first to purposefully name the growing subfield, \textit{Natural Enemy, Natural Ally: Toward an Environmental History of War}, published in 2004, identifies key themes in the emerging scholarship and suggests directions for future scholarship.

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research. At a basic level, the authors assert the importance of understanding the many and varied impacts of warfare on the environment. The effects of war can be both fleeting and enduring, direct and indirect, purposeful and unintended. War intensifies the use of some resources while taking pressure off of others. Case studies in the book illustrate these themes in examples of conflicts ranging around the world from the sixteenth century through World War II. Subsequent edited volumes and a handful of monographs have built upon these themes and continue to point the way toward a methodology for understanding the relationship between warfare and the environment.

Recent scholarship has begun to focus on the environmental history of World War II specifically. The Long Shadows: A Global Environmental History of the Second World War is the first to undertake a systematic approach to understanding the environmental impacts of that conflict and proposes a methodology for examining the relationship between warfare and environmental change. In his introductory chapter, Simo Laakkonen offers the concept of the

22 Tucker and Russell, Natural Enemy, Natural Ally.

23 Ibid., 4, 15-16.


“polemosphere” as a framework within which to understand the interactions between society, the environment, and war. As Laakkonen explains, the polemosphere is simply “those aspects of the environment and society that have been affected by warfare.” The polemosphere reaches far beyond the period of active conflict, both temporally and spatially. He argues that historians must look beyond the battles to the period of mobilization before conflicts; to logistical networks of human and material resources; to political, economic, and cultural changes; to the period of demobilization and beyond. Enlarging the scope of analysis of war and conceiving of the study of warfare in terms of the polemosphere enables historians to make connections and better understand the long-term and far-reaching consequences of war.

Essays in *The Long Shadows* and two subsequent volumes on the environmental history of the Second World War demonstrate the value of examining the war from the perspective of the polemosphere. *The Resilient City in World War II: Urban Environmental Histories* complicates the notion of war as a purely destructive force and instead argues that its power is more ambiguous. The war proved exceedingly destructive to many cities across the world. Examining the process of rebuilding, or avoiding destruction and instead taking advantage of economic mobilization, reveals new insights into the ways in which people and the societies and environments mobilize for and recover from war. Most recently, in *Nature at War: American Environments and World War II*, historians turn their attention specifically to the repercussions of the war in the United States. The authors emphasize the unprecedented quality of changes resulting from the war, arguing that “World War II played a transformative role in creating the

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27 Simo Laakkonen, et al., eds., *The Resilient City in World War II*. 
world we live in today – its built environment, material culture, and intellectual geography, as well as American landscapes around the country.”

The essays in this volume take a long-term view of the war within its historical context, outlining antecedent trends as well as following the aftermath of World War II into the Cold War era.

The analytical framework provided by Tucker and Laakkonen in their edited volumes serves as the foundation for analysis in this project. The evidence and conclusions presented here align with the findings of these scholars. But as environmental historians know, place is important, as different environments affect society in unique ways and vice versa. This study contributes new insights to our understanding of the environmental impacts of warfare by focusing on the Pacific Northwest, a relatively under-examined region in environmental and Western history.

Until the 1980s, the field of Western American history was dominated by Frederick Jackson Turner’s notion of the West as frontier. But historians began to rethink Western history as regional history, thereby opening up new areas of inquiry beyond the history of nineteenth century expansion. In her classic work that helped to redefine the field, *Legacy of Conquest*, Patricia Nelson Limerick identified several key themes in Western history: diverse environments, diverse peoples, continuity between past and present, and the significant role of the federal government in the region. Although the experience of the West in World War II resonates with

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29 Historians who ascribe to a regional understanding of western history generally define the West as the region west of the 98th or 100th meridian, where the arid climate and environment makes traditional Euro-American agricultural and lifeways practices more difficult. Donald Worster, “New West, True West: Interpreting The Region’s History,” *The Western Historical Quarterly* 18, no. 2 (1987): 141–156.

all of these themes, few historians have sought to examine the period in detail. Most often the
war appears as a chapter in works that cover a longer period of Western history. Or the war
serves to bookend studies of the West in the early twentieth century or the postwar era. The
lack of in-depth studies of the war leaves a significant aspect of Western history obscured in
assumptions and memory. As British sociologist Anthony Giddens asserts in his work on warfare
and modern society, “the impact of war in the twentieth century upon generalized patterns of
change has been so profound that it is little short of absurd to seek to interpret such patterns
without systematic reference to it.” Only a few historians have undertaken closer studies of
various aspects of the war in the West. Of these, Gerald Nash’s works *The American West

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33 Of course the war has not been completely ignored by Western historians, it just has not received the focused attention that such a complex and extraordinary episode in history warrants. Several historians have done excellent work unpacking particular aspects of the war. For example, R. Douglas Hurt’s *The Great Plains During World War II* (University of Nebraska Press, 2010), offers a regional examination of the Great Plains as an answer to Gerald Nash’s earlier work on World War II and the West. Connie Chiang’s recent work, *Nature Behind Barbed Wire: An Environmental History of the Japanese American Incarceration* (New York: Oxford University Press, 2018), sheds new light on the story of Japanese internment in the West. Erasmo Gamboa provides an important study on the Bracero Program in the Northwest in *Mexican Labor & World War II: Braceros in the Pacific Northwest, 1942-1947* (Seattle: University of Washington Press, 2000). The development of the atomic bombs in the West, including at Hanford, has its own set of literature, including John M. Findlay and Bruce W. Hevly’s *Atomic Frontier Days: Hanford and the American West* (Seattle: University of Washington Press, 2011) and Kate Brown’s *Plutopia:*. 
Transformed and World War II and the West stand out as the most comprehensive on the subject and provide the foundation upon which subsequent studies of the war are based.\textsuperscript{34}

In The American West Transformed, Nash offers an overview of the social and cultural effects of World War II in the West, and World War II and the West continues the theme by examining the economic impacts of the war. In these books Nash argues that “the Second World War transformed the American West. No other single influence on the region…brought such great and cataclysmic changes to the West.”\textsuperscript{35} Indeed, Nash asserts that the shift to war production compressed economic and political changes “that would have taken more than forty years in peacetime” into a span of four years.\textsuperscript{36} To show how these changes came about, Nash considers the experiences of different ethnic groups in the West, as well as those living in the booming western cities, exploring the social and economic conditions as well as the cultures that westerners created during the war. To explain the economic changes, Nash details the growth of major western war industries, with particular attention to the process of creating and managing the complex public-private industrial partnerships that fueled America’s war machine. Nash’s work is more expository than argumentative, as he intended both books to serve as jumping off points for future scholarship that would explore the war in the West in more depth.


\textsuperscript{35} Nash, \textit{The American West Transformed}, vii.

\textsuperscript{36} Nash, \textit{World War II and the West}, 1.
Subsequent scholars have relied up on Nash’s work for a basic understanding of the effects of World War II in the West. Most historians agree with Nash’s assessment of the transformative power of the war, but a few question the degree to which the war itself served as the driving force for change. In his books on California during the war, Roger Lotchin asserts that wartime changes had antecedents dating back to the First World War and represented continuity rather than a revolutionary shift for the state. Recently, several senior scholars of Western history turned their attention to the war on the seventy-fifth anniversary of American’s entry into the war in the edited volume World War II and the West it Wrought. While they do not disagree with Nash, they too see wartime changes as the product of earlier developments. “The chapters suggest that World War II did not so much represent a break with the past but rather an extension of it. From this perspective, the war proved to be less transformative than catalytic …with the war serving to channel, redirect, and amplify prewar flows.” The distinction between whether the war was a watershed, transformational, or part of a series of shifts already taking place is unimportant. What is important, and what this project seeks to do, is to understand the processes, connections, and decisions that created the Northwest as it emerged from the war with a diversified economy, new industries, a larger and more diverse population, and an altered environment.

37 Consult the footnotes or bibliography of most books that discuss some element of World War II and the West and Nash will be there. For example, in the most recent work on the topic, Mark Brilliant and David M. Kennedy’s edited volume, World War II and the West it Wrought (Stanford: Stanford University Press, 2020), much of the introduction that lays out the basic sweeping narrative of wartime changes in the West cites Nash’s The American West Transformed and Bruce Cumings, Dominion from Sea to Sea: Pacific Ascendancy and American Power (New Haven: Yale University Press, 2009), who in turn cites Nash.


39 Brilliant and Kennedy, eds., World War II and the West it Wrought, 4.
Much like the West, the Pacific Northwest eludes clearly-defined boundaries. Historians and residents alike define the region in numerous ways. The states of Washington and Oregon always serve as the core of the region. Idaho is frequently included; Montana, or just the northwest portion of the state, also makes appearances. Contemporary policymakers understood the region broadly as well. For example, the Pacific Northwest Regional Planning Commission, created in 1934 as part of the National Resources Board, included representatives from Washington, Oregon, Idaho, and Montana. Transnational studies or those taking a strict environmental approach to regional definition may also include British Columbia due to its geographic and climatic similarities to its neighboring states.

This study takes a narrow view of the region, focusing on only Washington and Oregon. The Columbia River and the resources it provides ties Oregon and Washington together politically, economically, and culturally. The Columbia River and the Cascade Mountains connect the states environmentally, creating a distinct region with a temperate western side and arid eastern side. The unique geography and climate of Washington and Oregon are distinct from

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42 *Pacific Northwest Quarterly*, the primary historical journal for the region, defines its coverage as “the northwestern United States, including Alaska and western Canada.” “Pacific Northwest Quarterly,” Center for the Study of the Pacific Northwest, University of Washington, https://www.washington.edu/uwired/outreach/cspn/Website/PNQ/PNQ%20Main.html. Several recent works take a transnational approach to defining the region, including Robbins and Barber’s *Nature’s Northwest*, which includes southern British Columbia, Washington, Oregon, Idaho, and Montana; and Hirt’s *The Wired Northwest*, which includes British Columbia, Washington, Oregon, and Idaho.
Idaho and Montana, which share more in common with the Intermountain West. Likewise, the experiences of Idaho and Montana during the war are more similar to their southern neighbors. Washington and Oregon both gained significant population during the war years and saw the growth of diverse manufacturing industries. Idaho and Montana both lost population and their contributions to the nation’s war effort were largely based on existing extractive industries, especially agriculture, lumber, and mining.\(^{43}\) Although British Columbia fits into Washington and Oregon’s bioregion, it is entirely separate politically, and a transnational comparison of the processes of war mobilization in Canada and the United States is beyond the scope of this study.

In order to untangle the many political, economic, and strategic factors at play during the war and the material results of those decisions for the environment in the Northwest, this study follows Cronon’s suggestion in *Nature’s Metropolis* to “open the boxes,” or in this case, the crates. “To understand the market, open the boxes: see the objects inside, then ask where they came from, who brought them here, who will buy them, and where they will go next. Follow the seller, follow the buyer.”\(^{44}\) This project journeys inside factories, opens crates, and disassembles weapons. It follows parts and materials from their origins to Northwest manufacturing facilities, uncovering the complex network of commodities, products, and capital at the heart of America’s war machine. Where the war materiel went next is well documented. But the process of production and the effects of production in the Northwest remain obscured. To illuminate this aspect of war mobilization, this study follows the relationship between seller (private industry) and buyer (the federal government) by examining official wartime histories produced by various


government agencies, agency reports, real estate records, correspondence, and industry publications. It follows the billions of dollars that flowed from Washington, DC into the Northwest in the form of New Deal projects, Defense Plant Corporation-funded projects, and contracts for products and material. This money not only built thousands of ships and aircraft, most of which do not survive today, but also countless structures and landscapes that continue to be important elements of the region’s environment in the present day. Understanding how federal policy plays out on the local level as well as appreciating the real, material consequences of those decisions and policies is a central goal of this project, allowing us to reconstruct one of the most transformational periods for the Pacific Northwest.

Using case studies of key resources and industries offers an instructive way to examine the material aspects of war and the relationships between industry and government within the context of a particular place. The first chapter explores the Northwest’s water resources and their development as the cornerstone for wartime economic and environmental change. For decades prior to the war, local boosters and planners sought to harness the power of the Columbia River and its tributaries for irrigation, navigation, and power generation. Through the outpouring of funds from the New Deal, reclamation advocates finally succeeded in securing funding for two massive dams on the river: Bonneville and Grand Coulee. Regional planners worked to rationalize the river and its resources, but their objectives shifted suddenly with the start of the war in the late 1930s. The resources provided by the Columbia and its dams served as the foundation for planners’ attempts to shape the development of the region and to try to steer the direction of war mobilization to further their goals. Electricity generated by the dams enabled war industries to develop in the region, attracting new industries and supporting the use of new
technologies, including aluminum manufacturing and plutonium production. The growth of these industries both realized and thwarted the goals of regional planners in unpredictable ways.

The response of the region’s forest products industry to the war is the focus of the second chapter. The war created an insatiable demand for Northwest forest products, from lumber to box shook to plywood. But in the decade before the war, forestry professionals had been calling attention to depletion of the region’s forest resources and advocating for more sustainable harvesting practices. This chapter explores what happened when increased demand met with various cultural, manpower, and technical limitations. Overall, the region saw an increase in harvests during the war years, but not to the same levels as the peak in the late 1920s. The extent and location of harvesting depended on strategic demand, environmental conditions, and the goals of the companies and agencies that controlled Northwest forests. The chapter also examines the shifting demand for wood for different products as the war progressed, following the trees from forest to mill to factories where the trees were transformed into lumber to expand the nation’s industrial and military infrastructure, aircraft parts to save aluminum, and crates to supply Allied offensives overseas.

During World War I, Northwest shipwrights used local lumber to craft wooden vessels for the Allied navies. But during World War II, the industry emerged in the region anew, constructing and repairing modern steel ships. The seemingly improbable development of shipbuilding in the Northwest is the subject of the third chapter. Far from sources of steel, machinery, and a skilled labor force, the Seattle-Tacoma and Portland metropolitan areas seemed an unlikely location for major shipbuilding operations. However, the Navy and Maritime Commission were desperate for ships and began to look for locations to expand production beyond the traditional shipbuilding centers along the East Coast. Suddenly, the Northwest’s
perceived liabilities became less important and the region’s resources were seen as advantageous. Northwest shipyards led the way in utilizing innovative practices for the construction of ships and shipyards, taking advantage of the region’s most plentiful resources: electricity and lumber. The growth of shipbuilding profoundly affected the region’s largest metropolitan areas, contributing to a population boom, increased urbanization and industrialization, and more intensive use of local resources.

The final chapter examines the region’s most famous contribution to the war effort: the production of aircraft. The Boeing Airplane Company was already an important fixture of Seattle’s industrial landscape by the time the war started. Contracts for the company’s B-17 and B-29 heavy bombers brought millions of dollars to the city and region, underwriting the massive expansion of Boeing’s physical plant and the development of new networks of subcontractors throughout the country. As with shipbuilding, economists and planners questioned the logic of aircraft production in the Northwest, but the war created a new logic for the industry. Boeing made strategic use of local resources in the development and construction of its aircraft. Electricity generated by the dams on the Columbia River powered Boeing factories and the new aluminum plants that supplied parts and materials for the aircraft. Even local forest products found new life in aircraft production when aluminum became scarce. The strategic success of Boeing’s aircraft and the company’s ability to produce them rapidly left lasting changes on the physical and economic landscape of the Northwest. The federally-subsidized expansion of Boeing reshaped Seattle’s industrial landscape and the company’s success as a military contractor became the foundation for a lasting military-industrial complex in the region.

In 1939, the authors of a study on industrial development in the Northwest noted that the “most important factor determining kind and rate of future industrial growth in [the] Pacific
Northwest is the attitude and policy of the federal government." As these case studies show, their assessment was correct. However, the attitudes and policies of the federal government shifted as a result of the war beyond what the planners could have anticipated. Although planners and policymakers tried to shape the region’s response to war toward certain goals, the chaotic nature of warfare led to unforeseen outcomes. The war reshaped the region’s environment, leading to more intensive use of the region’s resources and rapid industrial development. The region’s economy emerged from the war more diversified, as planners had hoped, but with new industries like shipbuilding, aluminum processing, and plutonium production that vexed economists and planners who sought to rationalize the region’s economy to its resources. Finally, the war engendered a more complex connection between the Northwest and the federal government, as contracts and funding poured into the region. The war and the industries that grew in the Northwest in response transformed the region in profound ways that continue to affect residents and their environment today.

45 “Notes Re Section XI Industries; Manufacturing;” Land Study - Industrial Development, 1939; Box 93; Correspondence and Related Records; Records of the National Resources Planning Board, Record Group 187 (RG 187); NARA Seattle.
CHAPTER ONE

“‘POWERHOUSE’ OF DEMOCRACY’:
NORTHWEST WATER RESOURCES AND INDUSTRIAL MOBILIZATION

Introduction

In September 1937, President Roosevelt traveled to Bonneville Dam to formally dedicate the structure as it neared completion. Before pressing the button which would “start everything going,” he remarked upon the significance of the dam for the Northwest and the entire country: “as I look on Bonneville Dam today, I cannot help the thought that instead of spending, as some nations do, half their national income in piling up armaments and more armaments for purposes of war, we in America are wiser in using our wealth on projects like this which will give us more wealth, better living and greater happiness for our children.”¹ What President Roosevelt did not know at the time, or dared not speculate to the public, was the crucial role that the Columbia River and the electricity it generated at Bonneville and Grand Coulee Dams would play in the Second World War. These dams were not built “for purposes of war,” but rather to reshape and modernize the Pacific Northwest. During the 1930s, local politicians, planners, and boosters in Oregon and Washington sought to bring federal dollars to the region to build infrastructure and diversify the region’s economy, enabling the region to grow beyond its status as a seeming colony of the East coast. To regional planners, the dams represented engines of prosperity for the

¹ Franklin D. Roosevelt, “Speech of the President Bonneville Dam, September 27, 1937,” Box 34, Franklin D. Roosevelt, Master Speech File, 1898-1945, Franklin D. Roosevelt Presidential Library and Museum http://www.fdrlibrary.marist.edu/_resources/images/msf/msf01115.
region. The dams would “reclaim” the “wasted” resources of the Columbia River, providing inexpensive electricity to cities and rural areas, delivering irrigation water to arid farmland, and improving navigation on the river to facilitate trade. Planners envisioned a new local economy based on what they saw as the rational use of the region’s natural resources, especially its mineral resources, which, in concert with the electricity generated by the new dams, would draw modern electrometallurgical processing industries to the region, thus diversifying the economy beyond simple extractive industries.

Almost immediately upon their completion, Bonneville and Grand Coulee Dams became the “‘powerhouse’ of Democracy,” as Secretary of the Interior Harold Ickes proclaimed to the Senate in 1943.\(^2\) War production boomed in the region in response to increasing hostilities beginning in the late 1930s. The inexpensive, readily-available electricity attracted modern shipbuilding facilities to the region in order to utilize the power for new electric welding construction techniques. The Columbia River’s cool water and electrical generating capacity became prime factors in the decision to locate the Army’s top-secret Manhattan Project site at Hanford, Washington. In addition, new electrometallurgical plants, particularly for magnesium and aluminum processing which required massive amounts of electricity, emerged throughout the region. As early as 1942, nearly 80 percent of the power produced by Bonneville and Grand Coulee dams went directly to Northwest industries. Throughout the war, an average of 90

\(^2\)“Statement by Secretary of Interior Harold L. Ickes before the US Senate Special Committee to Study Problems of American Small Business, to be delivered Wednesday, January 13, 1943,” p. 3; Preparedness - War Resources Council - File No. 1 188 (Part No. 6) [no date]; Box 2863; Central Classified Files, 1937-1953; Records of the Office of the Secretary of the Interior, Record Group 48 (RG 48); National Archives at College Park (NACP).
percent of all the power sold to industrial customers went to the region’s aluminum processing plants, which produced around one-third of all aluminum in the United States during the war.³

To planners, the war offered the potential to realize their goals to bring prosperity to the region through orderly, rational industrialization. However, the realities of war mobilization proved a challenge to the planners’ vision. The development of Northwest water resources served as a foundation for the region’s war industries, as the electricity generated by the dams enabled existing industries to expand and new industries to locate in the region. The wartime growth of these industries both realized and thwarted the vision of planners, contributing to the diversification of the region’s economy, but not necessarily to the rational use of the region’s resources.

Historical Context

The Columbia River is one of the key defining features of the Pacific Northwest. Flowing from its headwaters in southern British Columbia between the Selkirk Mountains and the Canadian Rockies, the river meanders south into Washington State before making a sharp turn west as the Snake River joins it in southeastern Washington, and flows west 210 miles to the Pacific Ocean. While not the nation’s longest river at approximately 1,243 miles, it is the second largest river in the United States by volume, and its river basin encompasses more than 258,000 square miles.⁴ Through its meandering course, the Columbia River and its twelve major tributaries connect the diverse ecosystems of the Pacific Northwest. As the river flows south


from its mountain origins in British Columbia, it follows the path cut by glacial waters thousands of years ago through basalt rock in the steppe-desert of eastern Washington. As it travels west, the river cuts through the Cascade Mountains, creating a stunning, tree-lined gorge as it emerges into the temperate, forested western halves of Oregon and Washington, before emptying into the Pacific Ocean.

The Columbia River also connects the diverse peoples and communities of the Pacific Northwest. The river plays a central role in the culture and livelihood of Native Americans throughout the region. For thousands of years, the peoples of the Columbia Plateau, today represented within the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe, relied on salmon from the Columbia River for subsistence. The river became a gathering place for obtaining food, trading with other groups, and celebrating. The construction of dams in the mid-twentieth century ravaged the region’s fisheries. For example, the inundation of Celilo Falls, known as Wy-am to the Columbia Plateau peoples, behind The Dalles Dam in 1957 destroyed a key fishing location and one of the most significant and sacred sites for Indigenous people. Despite severely depleted salmon runs, Native Americans continue to fish the Columbia today and the river remains an important aspect of their culture.\(^5\)

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Figure 2. Native Americans fishing for salmon at Celilo Falls, Oregon, 1941. Photo by Russell Lee. LC-USF346- 070154-D, Farm Security Administration/Office of War Information Photograph Collection, Prints and Photographs Division, Library of Congress.

Waterways became essential to trade and mobility for Euro-American settlers as they arrived in the Northwest beginning in the nineteenth century. Portland emerged as the region’s trade center in the mid-nineteenth century largely due to its location near the confluence of the Columbia and Willamette Rivers. The city acted as a hub connecting the hinterlands of the Willamette Valley and Columbia River Valley with the rest of the world via the Columbia River and Pacific Ocean. Regional transportation centered around waterways, which proved challenging due to the geology of the Columbia River. The river contained numerous hazards, especially Cascade Rapids and Celilo Falls, which necessitated offloading passengers and freight from one ship and then transferring them onto another ship on the other side of the obstacle to

continue the journey.\textsuperscript{6} Furthermore, navigating the treacherous currents and sandbars at mouth of the Columbia was, and remains, such a challenging feat that the State of Oregon established licensing for mariners specializing in navigating those waters to pilot ships through the passage.\textsuperscript{7} As traffic on the Columbia and Willamette Rivers increased and commerce in Portland expanded, the navigational challenges of the Columbia became increasingly intolerable. Two possible solutions to the problem emerged: build railroads to bypass the river and its obstacles, or reengineer the Columbia River.

During the last half of the nineteenth century, local and transcontinental railroads fanned across the region, connecting the Northwest with markets and capital in the Midwest and East Coast.\textsuperscript{8} Railroads began as adjuncts to river transportation in the Pacific Northwest, constructed beginning in the 1850s to bypass the most treacherous rapids on the Columbia River to facilitate navigation. By the 1880s, the transcontinental railroads began to arrive in the Northwest and a boom of construction and corporate consolidation followed. During the 1880s until the Panic of 1893 halted most construction, four major transcontinental railroads built routes in the Northwest. The Northern Pacific, Union Pacific, Southern Pacific (via the Oregon and California Railroad), and Great Northern all built routes that linked Seattle, Tacoma, Portland, and Spokane


\textsuperscript{7} The Oregon Board of Maritime Pilots was established by the territorial legislature in 1846 and remains today to ensure safe passage of vessels through the state’s major shipping waterways. “About Us,” Oregon Board of Maritime Pilots, https://www.oregon.gov/puc/bmp/Pages/About-Us.aspx.

with points east. Three of those railroads ran through Portland, reinforcing its position as the region’s trade center.\(^9\)

As the railroads laid track across the country and throughout the Northwest in the late nineteenth century, the United States Army Corps of Engineers worked to improve the navigability of Northwest waterways. The Corps of Engineers undertook major projects on the Columbia River, deepening the channel at its mouth to facilitate transportation for ocean-going vessels, and constructing locks and canals to bypass Cascade Rapids and Celilo Falls. Opened in 1896 and 1915, respectively, these canals enabled ships to reach hundreds of miles into the Inland Northwest, carrying wheat, wool, and other agricultural products to Portland for export. They also served as competition to the railroads, helping keep railroad freight rates in check.\(^10\) Each of these projects were major engineering feats for their time and took decades to complete. However, in the decades between planning and completion of the bypass canals, engineering and planning philosophy had moved beyond simple navigation improvements and toward large-scale, multipurpose projects that would contribute to regional development.\(^11\)

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Reclamation

Multipurpose dams became an important tool in the arsenal of early-twentieth-century planners seeking to make the “greatest good to the greatest number for the longest time” from the nation’s natural resources. Engineers, boosters, and bureaucrats steeped in Progressive-Era conservation ideals saw the water of the Columbia River as “wasted” potential. If they could “reclaim” the wasted energy and harness the river with dams, the water could be used for irrigation, navigation, and to generate electricity. But the prospect of river development posed myriad questions for reclamation proponents to solve. What purpose(s) would a dam serve? Who would benefit from a dam? Who should pay for dams and irrigation systems or power transmission systems? How would the expense be justified? Federal agencies and local stakeholders grappled with these questions throughout the first decades of the twentieth century. The crises of the Great Depression and World War II, and the federal response to them, ultimately brought answers and action, setting the stage for the reconfiguration of the Columbia River over the next four decades.

Initial efforts by white settlers to remake their rivers, beyond improving navigation, centered around diverting water for irrigation. Beginning in the late nineteenth century, individual farmers in the arid West constructed simple irrigation systems for their farms. As farming expanded and the need for water became more widespread, farmers turned to private

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capital to fund more elaborate systems. However, most such systems proved inefficient or ineffective, given the environmental conditions of the region. Conservationists and reclamation proponents recognized the failures of private enterprise and called on the federal government, with its greater capital and expertise, to step in. In 1902, Congress passed the National Reclamation Act to provide federal funding for irrigation projects with the goal of opening new parts of the West to settlement.\textsuperscript{14} Although the Reclamation Service (later Bureau of Reclamation) developed a handful of successful projects in the Northwest in the first decade of the twentieth century, the Act did not have the effect its proponents hoped for and farmers still struggled to secure reliable access to water.\textsuperscript{15}

World War I initiated a shift in the rhetoric of reclamation to focus more on river development for the generation of electricity rather than for irrigation. Even before the US became involved in the war, Northwest boosters recognized the latent resources afforded by the region’s rivers, especially the Columbia, and called for the development of hydroelectric power plants to meet the potential needs of war industries. In the 1916 report, “Oregon’s Opportunity in National Preparedness,” Oregon’s State Engineer argued that “We should not overlook the problem of making this power, which is now wasting, do a greater share of the drudgery in our homes and on the farm…. We should encourage the establishment of factories to utilize our great and varied resources.”\textsuperscript{16} The report went on to call for the construction of a dam on the Columbia

\textsuperscript{14} Worster, \textit{Rivers of Empire}, 163-167.

\textsuperscript{15} The most successful early projects that the Bureau of Reclamation undertook in the Northwest in the early twentieth century were the Klamath Project in Oregon and the Yakima Project in Washington. Many projects failed however, due to high costs for farmers, inappropriate choice of crops that failed or were grown cheaper elsewhere, and challenging environmental conditions. See Worster, \textit{Rivers of Empire}, 179 and Schwantes, \textit{The Pacific Northwest}, 298-301.

River at Bonneville to generate power for Portland industries and aid navigation upstream. Although the dam was not built during the war, existing power plants increased production to meet the needs of Northwest war industries. The increased demand for power and changes in electrical distribution prompted calls for creating connected networks of publicly-owned utilities in order to make electricity cheaper and more widely available.\(^{17}\) Advocates believed that the best way to increase power production and interconnectivity and to foster the growth of public utilities was through river development, especially on the Columbia. Although the region’s wartime industrial boom crashed in 1919, boosters nonetheless continued to advocate for hydropower, interconnectivity, and public utilities throughout the 1920s.

Local leaders in business and government in the 1920s pushed for river development under the guise of conservation. As the Oregon State Engineer explained, “the conservation of our water resources means development and use,” and that “the use of water will not diminish the supply for future generations.”\(^{18}\) These boosters believed that reclamation for the purposes of generating power, providing irrigation water, and aiding navigation was the greatest good for the region’s rivers, especially the Columbia. Northwest boosters worked with federal agencies and the region’s congressional delegation to promote their vision. Success came in 1925 in the River and Harbor Act, which called for the Corps of Engineers and the Federal Power Commission to estimate the costs of surveys of rivers across the nation where hydropower development was feasible. Their report to Congress, submitted in April 1926 and published as House Document


308, listed twenty-four river systems, including the Columbia, as having potential for hydropower development. Congress appropriated funds through the River and Harbor Act of 1927 for the Corps of Engineers to complete the surveys. The resulting report submitted to Congress in March 1932, *The Columbia and Minor Tributaries*, also known as the “308 Report,” outlined the economic justification for reclamation and recommended ten potential dam sites on the Columbia River. The report became the blueprint for development of the Columbia over the next forty years.\(^\text{19}\)

**The New Deal**

Although the 308 Report was extremely comprehensive, totaling nearly two thousand pages, it offered no recommendations regarding funding the proposed projects. Engineers, local boosters, and federal officials generally assumed that the projects would be undertaken as federal/state-private partnerships or by private enterprise with government oversight.\(^\text{20}\) The Corps of Engineers submitted the report to Congress during the depths of the Great Depression, and the likelihood of receiving funding, either public or private, seemed slim. However, Franklin Roosevelt saw reclamation, especially the types of large-scale projects proposed in the 308 Report, as opportunity. Dams on the Columbia River would not only generate inexpensive electricity, which in turn would stimulate the growth of industry, but their construction would provide thousands of much-needed jobs. Campaigning in the Northwest in 1932, Franklin Roosevelt promised support for public utilities and federal funding for hydropower projects.


Speaking to voters in Portland that September, Roosevelt declared, “And I state, in definite and certain terms, that the next great hydro-electric development to be undertaken by the Federal Government must be that on the Columbia River.”

Once Roosevelt took office in March 1933, Northwest boosters and politicians pushed the new president to keep his promise. The members of Congress from Oregon and Washington each vied for funding for the dam proposed in the 308 Report that would most benefit their constituents: the dam at Warrendale in Oregon, which would provide power to Portland, and the dam at Grand Coulee in Washington, which would provide power and irrigation water for the Columbia Basin. Roosevelt appropriated funds for Grand Coulee Dam in July 1933, and after aggressive lobbying by Senator Charles McNary and Representative Charles Martin of Oregon, President Roosevelt earmarked funding from the National Industrial Recovery Act for a dam at Bonneville (just upstream from the initially-proposed site at Warrendale) in September 1933. The authors of the 308 Report did not intend for all ten proposed dams to be constructed at once, but rather a gradual development as economic conditions warranted. The choice to fund Grand Coulee and Bonneville first hinged on their potential to create jobs in the immediate term and on their potential as anchors for rural and urban development based on the irrigation water and electricity they would provide over the longer term.

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23 Ibid., 208-210.
Bonneville and Grand Coulee Dams became the foundations of New Deal-era regional development plans in the Northwest. An important, and often overlooked, aspect of the New Deal was the attention paid to planning in order to ensure federal funds were put to the best use. The federal government began its first and only effort toward national planning in July 1933 when Secretary of the Interior and head of the Public Works Administration (PWA) Harold Ickes created the National Planning Board within the PWA. Building upon Progressive-Era city and regional planning efforts, the National Planning Board emerged as a means of directing the efforts of the New Deal.\(^{24}\) Over the decade of the organization’s existence, the National Planning Board evolved, eventually reorganizing into the National Resources Planning Board (NRPB), an independent agency that reported directly to President Roosevelt.\(^{25}\) The NRPB had four primary goals: to plan public works projects; to coordinate federal planning activities; to encourage planning on the regional, state, and local levels; and to engage in research to inform planning and policymaking.\(^{26}\) As Roosevelt explained it in his speech dedicating Bonneville Dam in 1937, “the responsibility of the Federal Government for the welfare of its citizens will not come from the top in the form of unplanned, hit or miss appropriations of money, but will progress to the National capital from the ground up — from the communities and counties and the states which


\(^{25}\) Marion Clawson, *New Deal Planning: The National Resources Planning Board* (Baltimore: Johns Hopkins University Press, 1981), 40, 43. The National Planning Board existed from July 1933 to June 1934, and was replaced by the National Resources Board. That organization lasted until June 1935 until it was replaced with the National Resources Committee. The National Resources Planning Board replaced the National Resources Committee in July 1939 and lasted until 1943, when Congress refused to continue to fund it. For simplicity, I will use the NRPB when referring to the federal planning agency in general, since that iteration of the agency lasted the longest and was the most active, and the appropriate antecedent agency when referring to the agency during a specific period of time.

\(^{26}\) Ibid., 86.
lie within each of the logical geographical areas.”27 Although the NRPB was a purely advisory organization and did not have authority to enact policy, the reports that the agency produced not only provided hard data on myriad economic and social issues, but captured the spirit of New Deal liberalism and inspired real change nationally and on the local level.

The NRPB fostered the development of local planning organizations around the country, including in the Pacific Northwest. Indeed, the Northwest became one of the most active regions in the country in terms of engaging in regional planning and research.28 Both Oregon and Washington established their own state planning agencies in 1934. In the same year, representatives from those states, along with Idaho and Montana, joined together with a regional representative from the PWA to form the Pacific Northwest Regional Planning Commission, the regional arm of the NRPB. In 1938, local planners also established the Northwest Regional Council, a non-governmental organization composed largely of members of the state and regional planning organizations, but with a more public-facing, education-focused mission.29 Through the work of these organizations, planners pursued two primary goals for the Northwest: to promote the “orderly utilization and conservation” of the region’s resources and to diversify the region’s economy.30

One of the most vexing issues facing the region was its reliance on extractive industries, especially logging and agriculture, and lack of manufacturing. Indeed, by the late 1930s, more

27 Franklin D. Roosevelt Speech at Bonneville Dam, September 28, 1937, p. 5-6.

28 Clawson New Deal Planning, 11. Regional planners defined the Pacific Northwest as the states of Washington, Oregon, Idaho, and western Montana, but again, the focus of this project is limited to Oregon and Washington.


than seventy-five percent of the region’s workers still depended on extractive industries for their livelihood.\textsuperscript{31} In numerous reports, planners lamented the region’s “colonial” status and the “relative immaturity of the [region’s] economy—with its emphasis on the extraction of farm, forest, and mineral materials and its deficiency in manufacturing activity.”\textsuperscript{32} As Secretary Ickes explained it, the West was “a nut to be cracked, the succulent meat of which was to fatten Wall Street. The empty shell was left for the farmers and the tradesmen of the West to gnaw upon until they could hopefully produce another nut to meet the fate as of its predecessor.”\textsuperscript{33} The predominance of extractive industries left the local economy subject to the sometimes extreme ebbs and flows of the markets for those commodities. The volatility of the markets, along with the seemingly unlimited natural resources available, encouraged waste and inefficient use of resources, especially in the lumber industry, and led to environmental degradation by the 1930s.\textsuperscript{34} “The waste of productive resources, both natural and human, that seems to be inherent in our present economic structure is appalling,” James Rettie, a consultant with the Pacific Northwest Regional Planning Commission, wrote in 1939. “We must find some way to bring


\textsuperscript{32} Ivan Bloch, “Industrial Opportunities and Northwest Resources,” (paper presented at the Western Chemical Conference, San Francisco, CA, August 9, 1939): 4; Pacific Northwest Regional Planning Commission, \textit{Development of Resources and of Economic Opportunity in the Pacific Northwest}, 93. William Robbins has written extensively about the colonial economy of the Northwest and attempts to move away from extractive industries. For example see William G. Robbins, \textit{Colony and Empire: The Capitalist Transformation of the American West} (Lawrence: University Press of Kansas, 1994), and \textit{Landscapes of Promise}.

\textsuperscript{33} Harold Ickes, speech at the Chamber of Commerce, Spokane, WA, August 19, 1941, Box 341, Speeches, Chamber of Commerce, Spokane, Washington, 8-19-41. #295 (324), Harold L. Ickes Papers, Manuscript Division, Library of Congress (hereafter cited as Harold L. Ickes Papers).

about greater stability of employment, and to rehabilitate certain large areas that have been
depleted of their original resources.”

Planners saw the Columbia River as one of the region’s most important resources and
Bonneville and Grand Coulee Dams as drivers for “orderly” development and economic
diversification. How best to use the electricity and irrigation water generated by the dams
became a major focus for Northwest planners. As planners noted, “the direction of economic
development in the Pacific Northwest will be determined in large part by the uses to which its
water resources are put.” Beginning with a 1936 preliminary regional planning report, planners
advocated resettling farmers from marginal lands onto irrigated tracts in the Columbia Basin, and
attracting a diverse array of industries to the region to utilize the inexpensive electricity. With
irrigation water from Grand Coulee Dam, the Columbia Basin Project would further planners’
goal of conservation of the region’s resources. The arid lands of the Columbia Basin would
become productive farmland for specialized agriculture enabling farmers to produce more
efficiently and profitably. To planners, agriculture was the wisest use of the shrub-steppe desert
that would produce the greatest benefit to the greatest number of people over the long term.

Bibliography (Portland: Northwest Regional Council, 1939), 247.

36 Pacific Northwest Regional Planning Commission, Development of Resources and of Economic Opportunity in
the Pacific Northwest, 117.

Printing Office, 1936), viii-x; Pacific Northwest Regional Planning Commission, Pacific Northwest Water
Resources and Their Future Development, Report to the National Resources Committee (October, 1936), 17;

38 Pacific Northwest Regional Planning Commission, Pacific Northwest Water Resources and Their Future
Development, 16-17; National Resources Committee, “Drainage Basin Committee Report for the Pacific Northwest
Basin Irrigation Project,” Proceedings of the Annual Meeting (Western Farm Economics Association) 14 (June 25,
26, 27, 1941): 161-164.
Attracting new industries to the Northwest with inexpensive and plentiful hydroelectric power would fulfill another of the regional planners’ major goals: to diversify the region’s economy. Planners wanted to move the region beyond its status as a “colonial empire” that exported raw materials and imported manufactured goods. In the major planning documents published in the late 1930s and early 1940s, planners focused on fostering manufacturing industries that would utilize the region’s natural resources. Economists believed that in order to be profitable, manufacturing industries in the Northwest had to use local resources, since railroad freight rates for shipping raw materials into the region and exporting products to eastern markets would drive up the costs of the final product. With this economic logic in mind, planners identified electrometallurgical and electrochemical processing as potential industries to cultivate. These industries required massive amounts of electricity, of which the Northwest would have a surplus once Bonneville and Grand Coulee began generating power.

Bonneville Power Administration

As construction of Bonneville and Grand Coulee Dams progressed throughout the mid-1930s, planners, politicians, boosters, and detractors grappled with how best to administer the projects and what to do with the electricity they would soon produce. After nearly five years under construction, Secretary Ickes officially opened Bonneville Dam on July 9, 1938. The dam

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41 Both dams were incredibly innovative and complex undertakings. For more on their design and construction, please see Billington, et al., *The History of Large Federal Dams*; Abbie B. Liel and David P. Billington, “Engineering Innovation at Bonneville Dam,” *Technology and Culture* 49, No. 3 (July 2008); Paul C. Pitzer, *Grand Coulee: Harnessing a Dream* (Pullman: Washington State University Press, 1994); and William F. Willingham, *Waterpower in the “Wilderness”: The History of Bonneville Lock and Dam* (Portland: US Army Corps of Engineers, 1987). Both dams also negatively impacted anadromous fish populations. Engineers and fisheries scientists in the 1930s attempted to mitigate the effects of the dams as much as possible. In the case of Grand
had been producing electricity since March 1938, with two powerplants generating 86,400 kilowatts. Over the next five years, workers added eight additional generating units to the dam, bringing its total capacity up to 518,400 kilowatts.\textsuperscript{42} Grand Coulee took workers nearly ten years to complete. Observers heralded the dam as “The Eighth World Wonder,” “The Biggest Thing on Earth,” and, derisively, “the goldarnedest chunk of concrete ever poured;” superlatives which Coulee, which completely blocked fish migration, scientists built a hatchery downstream and caught returning salmon and released them at the hatchery until the population learned to migrate to the hatchery instead of getting trapped by the dam. At Bonneville, engineers built fish ladders, fish locks, and passageways to enable spawning salmon to return upstream and smolts migrate to the ocean. These measures were reasonably effective, though certainly imperfect. The sheer number of dams constructed in the postwar era and their effects on water flow and temperature resulted in the dramatic decline in salmonid population we see today. For more on Columbia River salmon and dams, please see Lisa Mighetto and Wesley J. Ebel, “Saving the Salmon: A History of the U.S. Army Corps of Engineers’ Efforts to Protect Anadromous Fish on the Columbia and Snake Rivers” (Seattle: Historical Research Associates, 1994); Blaine Harden, \textit{A River Lost: The Life and Death of the Columbia} (New York: W.W. Norton, 1996); and Richard N. Williams, ed., \textit{Return to the River: Restoring Salmon to the Columbia River} (Burlington, MA: Elsevier Academic Press, 2006).

\textsuperscript{42} Willingham, \textit{Waterpower in the “Wilderness”}, 12, 18-19, 27.
are understandable upon viewing the dam in person. Its massive scale, at more than 5,000 feet long, 550 feet high, and comprised of nearly 12 million cubic yards of concrete, dwarfs Bonneville and Hoover (then Boulder) Dams. The dam’s first generator began producing electricity in October 1941, and an additional two units came on line in early 1942, producing more than 300,000 kilowatts. Over the course of the war, workers installed a total of ten of the eighteen planned generating units at Grand Coulee, enabling the dam to produce more than 800,000 kilowatts by 1944. Engineers projected that together Bonneville and Grand Coulee would ultimately produce a combined total of more than two million kilowatts of electricity, tripling the region’s power supply.

Figure 4. Grand Coulee Dam, Washington, 1941. LC-USW33- 035035-C, Farm Security Administration/Office of War Information Photograph Collection, Prints and Photographs Division, Library of Congress.

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To manage the distribution of the electricity generated by the dams, planners, local politicians, and members of Roosevelt’s administration proposed a number of different plans. The most far-reaching proposal was for the creation of a “Columbia Valley Authority” (CVA), inspired by the success of the Tennessee Valley Authority. Beginning in 1935 and through the 1940s, Northwest congressmen proposed numerous bills to establish a CVA as a comprehensive regional resource management agency centered upon the electricity generated by Bonneville and Grand Coulee Dams. Although the CVA concept had the support of Secretary Ickes and President Roosevelt, the regional planning agencies and other Northwest congressmen opposed the plan as redundant, given the roles of existing agencies, or for investing too much authority in one agency.\textsuperscript{45} The CVA bills failed to gain traction, so the administration proposed a compromise management plan, establishing the Bonneville Project Administrator under the Department of the Interior in 1937. Intended as a temporary measure until the CVA could be created, the office evolved into the Bonneville Power Administration (BPA) in 1940 and became the permanent agency responsible for the marketing and distribution of power generated by Bonneville, Grand Coulee, and the subsequent dams built on the Columbia and its tributaries in the postwar era.\textsuperscript{46}


\textsuperscript{46} Hirt, The Wired Northwest, 269-274. For simplicity’s sake I will refer to both the Bonneville Power Administrator’s office and Bonneville Power Administration as BPA regardless of year, unless specifically referencing a difference between the two administrative bodies. For more on the BPA, please see Hirt, The Wired Northwest; Gus Norwood, Columbia River Power for the People: A History of Policies of the Bonneville Power Administration (Portland: Bonneville Power Administration, 1981); and Gene Tollefson, BPA and the Struggle for Power at Cost (Portland.: Bonneville Power Administration, 1987).
The BPA had two priorities upon its creation: to construct a distribution system to deliver hydropower throughout the region, and to secure markets for that electricity. These two functions would serve the overall development goals of planners and advance several goals fundamental to New Deal liberalism, including disrupting monopolistic business practices, supporting public power, and promoting the conservation of natural resources (as they understood it at the time). The enabling legislation mandated that the BPA build and operate its own transmission system and give preference in the sale of electricity to public-owned utilities, “in order to encourage the widest possible use of all electric energy that can be generated…and to prevent the monopolization thereof by limited groups” and “to insure that the facilities for the generation of electric energy at the Bonneville project shall be operated for the benefit of the general public.”

BPA power would electrify rural areas of the Northwest and provide a surplus of power to cities, which planners and BPA economists hoped would attract industrial customers. Using the language of conservation, BPA’s first administrator, J.D. Ross, explained in The Oregonian that “the goal sought by the President and Secretary Ickes at Bonneville is the greatest good to the greatest number. This in turn means the widest use of electricity for everybody.”

The actions taken by the BPA in the mid- to late-1930s inadvertently enabled the region to respond quickly to the war emergency as it developed in the early 1940s. J.D. Ross and his successor Paul Raver, enacted forward-thinking policies that compelled the BPA to construct its infrastructure to be able to meet future needs, rather than just to suit the present market. The BPA built its transmission system as a regional grid, connecting Bonneville and Grand Coulee.


48 “Low Bonneville Rates Ross’ Aim,” Oregonian (Portland, OR), October 11, 1937.
Dams and transmitting their power throughout the Northwest through spur lines and tie-ins to existing public and private power systems. As Raver explained to a group of engineers in Portland in 1939, “Bonneville cannot continue to be an isolated dam. It must be linked with the other hydro and steam plants of the region. Such a program will not only assure a more stable and reliable power system, but it will provide millions of dollars worth of additional prime power for industries that seek low-cost electric energy.” In 1940, The Oregon Journal called the interconnected grid “one of the sanest suggestions that has come from the Bonneville administration.” Though constructed to rationalize power transmission, maximize its use, and keep rates low, the Northwest’s power grid ended up serving as the foundation of the region’s wartime industrial mobilization.

But before the nation mobilized for war, the BPA struggled to secure customers for its electricity. Critics of Bonneville and Grand Coulee abounded throughout the 1930s, calling Grand Coulee “Roosevelt’s Folly” for spending so much on a dam that would generate power “for which there can be no market for years to come.” Eastern papers like the Chicago Daily Tribune lambasted “the absurdity of the government’s colossal expenditures for power development in the northwest…in an area, most of which consists of desert and mountains,” and questioned “who will be found to consume this enormous additional quantity [of electricity]?”


50 Dr. Paul J. Raver, “Columbia River Power for Industry,” An address delivered at a meeting of the Oregon Section of the American Institute of Mining and Metallurgical Engineers, Portland, Oregon, October 16, 1939, p. 8, Box 432 Samuel Moment Collection, Bonneville Power Administration Library, Portland, Oregon (hereafter cited as Moment Collection).


52 Draft article on the role of PWA in national defense, Box 119, Articles: Miscellaneous, “PWA Spent a Billion for Defense!”, Harold L. Ickes Papers; Bessey, Pacific Northwest Regional Planning, 31.
Critics answered that “there is no market remotely in sight for the power and local concerns have enough excess capacity installed to care for normal growth for ten years or more.”53 But to the proponents of Bonneville and Grand Coulee, the dearth of current markets was part of the point. The Roosevelt administration intended the projects to create jobs in the present while attracting and preparing for markets in the future. In Ickes’ colorful words, “when our grandchildren visit Grand Coulee Dam…they and their children will think of this as an age of far-seeing planners and expert builders. They will be grateful for the foresight and the energy of a great President which have made fruitful and productive a great barren area.”54

The BPA and regional planning agencies worked together to identify industries they believed would benefit from plentiful, inexpensive power and at the same time, advance the overarching development goals of wise use of local resources and diversification of the region’s economy. Planners argued that light metals processing, especially aluminum and magnesium, could be done profitably in the Northwest. Although much of the raw material would have to be imported, planners believed the inexpensive electricity would make up for that cost.55 Based on the planners’ studies, Raver and Ickes worked to secure contracts with light metals manufacturers to build plants in the Northwest. But as planners conducted research and the BPA


built transmission lines, the geopolitical landscape shifted and disrupted the planners’ carefully crafted blueprint for orderly, rational regional development based on Columbia River power.

“‘Powerhouse of Democracy’”

The war both advanced and hindered regional planners’ vision for the Northwest. Planners sought to use the Columbia River hydropower projects as the anchor for a new regional economy based on extractive industries and diversified manufacturing. War mobilization almost immediately shifted the economic logic of the market and changed the character of possibilities for manufacturing in the region. Prior to the war, manufacturing in the Northwest lagged behind other regions due to the distance between sources of materials, sites of production, and markets. Machinery manufactured in the Northwest destined for East Coast markets could not compete with machinery produced in the Midwest due to the cost of transportation.\textsuperscript{56} But the war created global markets, generated demand for new products, and triggered a sense of urgency for production, making the location of the Northwest less of an economic liability. In this new environment, Columbia River power emerged as the asset and inducement to industry that New Deal planners had envisioned.

Bonneville and Grand Coulee Dams became the “‘Powerhouse’ of Democracy.”\textsuperscript{57} The inexpensive and plentiful electricity they generated coupled with wartime demand for manufactured goods to attract war industries to the Northwest. The growth of manufacturing industries contributed to the diversification of the region’s economy beyond extractive industries,


\textsuperscript{57} “Statement by Secretary of Interior Harold L. Ickes before the US Senate Special Committee to Study Problems of American Small Business, to be delivered Wednesday, January 13, 1943,” p. 3; Preparedness - War Resources Council - File No. 1 188 (Part No. 6) [no date]; Box 2863, Central Classified Files, 1937-1953; RG 48; NACP.
thus achieving one of the regional planners’ central goals. Planners did not see all manufacturing as equally advantageous, however. Forest products and light metals manufacturing represented the ideal type of industries that planners sought to encourage because they used local resources and raw materials to create value-added products. Other wartime industries that benefited from BPA’s power, such as shipbuilding and aircraft manufacturing, were met with suspicion by planners who questioned the logic of their location in the Northwest, far from necessary raw materials and markets.\footnote{National Resources Planning Board, \textit{Pacific Northwest Region Industrial Development}, 21-23; Pacific Northwest Regional Planning Commission, \textit{Development of Resources and of Economic Opportunity in the Pacific Northwest}, 12-13.} Recalling the wartime boom and spectacular postwar bust of these industries during World War I, planners did not believe such industries had a permanent future in the region.

Two entirely novel industries that developed in the region as a result of the war, aluminum and plutonium manufacturing, illustrate the ways in which the war impacted planners’ vision for the Northwest. The Department of Interior purposefully recruited the aluminum industry to the Northwest to take advantage of its plentiful power and bring diversified manufacturing to the region. Officials in Washington, DC and Portland worked hard to ensure that the industry would endure into the postwar era and not end up a just “war bab[y].”\footnote{Ivan Bloch, “Pacific Northwest Mineral Conference - Reed College, March 14, 1942,” p. 22; Minutes and Speeches - Mineral Conference; Box 2863; Department of the Interior, Office of the Secretary, Central Classified Files, 1937-1953; RG 48; NACP.} Plutonium production, on the other hand, arrived in secret to take advantage of Columbia River water and power. But the Hanford Engineer Works upended planners’ goals by taking a large area of agricultural land out of the Columbia Basin Project while creating an element with
extraordinary destructive powers, surely not something that represented the greatest good for the
greatest number over the long term.

**Aluminum**

For decades, the Northwest served as a colony to the eastern half of the country, supplying raw materials to manufacturers and realizing only modest economic benefits from the resources extracted from the region’s soil. Bonneville and Grand Coulee Dams created a new resource essential to manufacturing but incapable of export, requiring industries to locate in the Northwest in order to take advantage of the resource. Planners believed that if they could entice electrometallurgical and electrochemical processing industries to the region to use BPA power, those industries would become the basis for diversified manufacturing in the region. Aluminum manufacturing emerged as the first such major industry in the region, its arrival coinciding fortuitously with the approach of war. The Northwest aluminum industry played an important role in the nation’s war mobilization, becoming a major supplier of a critical material. The aluminum industry reshaped the region’s physical and economic landscape, creating new networks of commodities and capital. These networks largely advanced planners’ vision for the region by contributing to the diversification of the region’s economy, dispersing industry throughout the region, and purchasing large blocks of BPA electricity, thus justifying New Deal reclamation projects.

The process of manufacturing aluminum involved numerous steps and a global network of resources, making it a logistically complex undertaking, especially in wartime. Prior to and

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during the war, the production of aluminum began with the mining of bauxite. At that time, the United States imported approximately sixty-five percent of its bauxite from Suriname, with the remainder supplied by limited domestic sources in Arkansas, Georgia, and Alabama. Bauxite came by ship from Suriname, via Trinidad, to one of two refineries in Mobile, Alabama, or East St. Louis, Illinois. In the refinery, bauxite was heated in a pressurized tank to extract molten aluminum oxide (alumina), in a method called the Bayer process. The production of one ton of alumina required two tons of bauxite and three-quarters of a ton of coal or other fuel. The cost of fuel and bauxite comprised around seventy-five percent of the cost of the alumina, thus making it most economical to locate refineries close to sources of fuel or bauxite. The next step in aluminum production converted alumina to aluminum through the Hall-Héroult process. At a reduction plant, alumina was dissolved in a bath of molten cryolite (sourced from Greenland) in a “pot” where it was electrolyzed through carbon electrodes with a low-voltage, high amperage charge. Pure molten aluminum collected at the bottom and was poured into molds to create ingots or “pigs.” Due to the substantial amount of electricity used in this process, aluminum reduction plants were usually located near hydroelectric power plants or other sources of inexpensive electricity. After molding pure aluminum ingots or alloying them with other metals, such as magnesium or zinc, the ingots were transported to fabrication plants. Workers pressed, extruded, forged, or casted the metal into sheets, plates, tubes, rods, cables, rivets, and numerous other parts. Most fabrication plants were located in the Midwest and East Coast near the manufacturers who purchased the parts in order to minimize transportation costs.

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Over several decades of maneuvering, the Aluminum Company of America (Alcoa) created a vertically integrated monopoly on aluminum in North America, controlling all steps of production, from the bauxite deposits to fabrication plants. Alcoa prevailed as the sole producer of aluminum in the US until 1941, and its Canadian subsidiary, Alcan, held similar power in Canada. The company’s entire production process took place in plants located east of the Mississippi, requiring western manufacturers, including the region’s many aircraft companies, to import aluminum. Alcoa’s monopoly proved not only economically disadvantageous, but hazardous from a national defense perspective. As hostilities commenced in Europe in 1939, the US military found itself entirely reliant on one producer for all of the aluminum necessary to build weapons for the impending war, leaving the nation vulnerable to any supply chain disruptions.

Bringing aluminum production to the Pacific Northwest would accomplish a number of important goals for the Roosevelt administration. Inexpensive BPA hydropower served as an essential resource for alumina reduction, helping to lower the cost of producing aluminum ingots. For the BPA, this meant the ability to sell large quantities of the power just becoming available from Bonneville and Grand Coulee Dams, thus proving to critics the value of those dams. From a planning perspective, alumina reduction plants represented an efficient use of local resources and could serve as the foundation for diversified manufacturing in the region by


63 For more on Alcan and Alcoa’s activities in Canada, please see Matthew Evenden, *Allied Power: Mobilizing Hydro-Electricity during Canada’s Second World War* (Toronto: University of Toronto Press, 2015).

64 Letter to Frank Knox, Secretary of the Navy, from Harold Ickes, February 24, 1941; Box 2791; Department of the Interior, Office of the Secretary, Central Classified Files, 1937-1953; RG 48; NACP; Gerald D. Nash, *World War II and the West: Reshaping the Economy* (Lincoln: University of Nebraska Press, 1990), 91.
attracting fabrication plants to supply local producers, especially in the aircraft industry. From an economic perspective, encouraging new aluminum producers to take advantage of Northwest resources would disrupt Alcoa’s monopoly. The Justice Department had already filed an antitrust lawsuit against Alcoa in 1937 seeking to break up the company. Within the Interior Department, Secretary Ickes emerged as an outspoken critic of Alcoa, pursuing policies to stymie the monopoly as much as practicable. Furthermore, from a strategic perspective, diversifying the number of producers and locations of aluminum manufacturing would create a more reliable supply chain and bring the production of aluminum closer to final consumers.

In December 1939, Alcoa announced that it would build an alumina reduction plant in Vancouver, Washington, the first aluminum manufacturing facility of any type located on the West Coast. Local journalists heralded the plant as a “three million dollar Christmas present” for the city, expecting that the facility represented “but an initial development” for an integrated aluminum industry in the region. Alcoa had approached BPA in September about constructing an alumina reduction plant in the Northwest and selected a site along the Columbia River in Vancouver due to its proximity to Bonneville Dam and port facilities with access to rail and water transportation. Alcoa became BPA’s first industrial customer, signing a 20-year contract for direct purchase of BPA power. Using alumina from Alcoa’s Mobile, Alabama refinery, the

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66 Nash, World War II and the West, 92-93; Stein, “Fighting for Aluminum.” 8; Paul J. Raver, Industries Important to National Defense Feasible of Establishment in the Pacific Northwest (Portland: Bonneville Power Administration, July 1940), i-ii.

67 “Alcoa To Build Huge Plant Here,” Columbian (Vancouver, WA), December 25, 1939.
Vancouver reduction plant began producing aluminum ingots in September 1940, just as the nation began to experience an aluminum shortage.\textsuperscript{68}

Aluminum emerged as one of the most critical materials for the Allied war effort. As the primary material used in the fabrication of modern warplanes, aluminum was essential to build the “swarms of airplanes” needed for national defense.\textsuperscript{69} In May 1940, Roosevelt called on Congress to fund a rearmament program that would include the production of 50,000 new airplanes per year. Alcoa assured the Office of Production Management (OPM) and National Defense Advisory Commission that it could supply all the aluminum necessary for Roosevelt’s rearmament program without expanding its production facilities.\textsuperscript{70} But by December 1940, it became apparent that Alcoa, despite its claims to the contrary, could not keep up with demand from the aircraft industry. As a result, aircraft production fell behind schedule in 1941. The Senate’s Special Committee Investigating the National Defense Program that summer found that “Alcoa had convinced OPM of the adequacy of the supply in order to avoid the possibility that anyone else would go into a field which they had for so many years successfully monopolized. How they expected to take care of the situation when the shortage would become apparent is not


\textsuperscript{69} US Senate, Special Committee Investigating the National Defense Program, “Report on Aluminum Investigation,” June 26, 1941, p. 1; Box 2791; Department of the Interior, Office of the Secretary, Central Classified Files, 1937-1953; RG 48; NACP.

clear.” In 1940, Alcoa had the capacity to produce 375 million pounds of aluminum per year; by 1941, OPM estimated that the military alone would require 1.6 billion pounds in the next year. Alcoa’s failures opened the door for rapid expansion of the aluminum industry, especially in the Pacific Northwest.

The nation’s desperate need for aluminum along with the Northwest’s available electricity made the region an attractive location for alumina reduction plants. In order to increase aluminum production as quickly as possible, the federal Defense Plant Corporation (DPC) would finance and construct the facilities and contract with private companies to operate the plants. Ickes warned Roosevelt in July 1941 that if the government failed to attract operators other than Alcoa to the industry, then “we are in danger of strengthening and enlarging existing monopolies as well as of creating new ones.” To prevent this scenario, Ickes and Raver encouraged DPC to construct smaller plants distributed throughout the Northwest, rather than only a few large plants located in the major metropolitan areas. Planners and Interior Department officials believed this infrastructure would enable smaller firms to acquire and successfully operate the plants after the war, rather than becoming “a Christmas present of all of our expensive facilities [for] the Aluminum Company [of America].” Thus BPA played a difficult

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72 “Statement of the Secretary of the Interior, Harold L. Ickes, Before the United States Senate Special Committee to Investigate the National Defense Program, June 16, 1941,” p. 3, Box 335, Statements before Senate Committee Investigating National Defense Program, #289, (318), Harold L. Ickes Papers.

73 Letter to President Roosevelt from Harold Ickes, July 14, 1941, Box 121, 1941 July Duplicates, Moment Collection.

74 “Statement of the Secretary of the Interior, Harold L. Ickes, Before the United States Senate Special Committee to Investigate the National Defense Program, June 16, 1941,” p. 7, Harold L. Ickes Papers.
balancing act during the war, accommodating Alcoa’s expansion in the Northwest, while assisting new companies in establishing operations in the region and ensuring that the physical infrastructure of the industry would, as Raver explained, “fit the regional economy after the defense effort is over.”

In 1941, the Reynolds Metals Corporation opened the nation’s first non-Alcoa alumina reduction manufactory in Longview, Washington. BPA and the Interior Department worked together with Reynolds to establish a plant in the Northwest, rather than provide Alcoa additional electricity for its Vancouver plant, which would violate the anti-monopoly provision in BPA’s enabling legislation. Reynolds received a total of $45 million in loans from the Reconstruction Finance Corporation for expansion, including $5 million to build the plant along the Columbia River, with three potlines capable of producing 66 million pounds per year. BPA secured a second independent alumina reduction plant for the region later in 1941, constructed and financed through the DPC and operated by Olin Corporation. Located in Tacoma, the Olin plant began producing aluminum in August 1942 with a capacity of around 40,000 pounds per year. Though modest in capacity, producing just seven percent of the nation’s aluminum by 1943, these two plants represented an important success for BPA’s mission.

In addition to the independent plants, BPA also contracted with Alcoa in 1941 to provide power for two additional alumina plants, one east of Portland in Troutdale, Oregon, and the other

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75 Quoted in Nash, World War II and the West, 97.

76 “Statement of the Secretary of the Interior, Harold L. Ickes, Before the United States Senate Special Committee to Investigate the National Defense Program, June 16, 1941,” p. 5, Harold L. Ickes Papers; Surplus Property Board, Aluminum Plants and Facilities, 21-23; Bonneville Power Administration, Pacific Northwest Opportunities, 17.

77 “Aluminum Plant Starts,” Tacoma News Tribune (Tacoma, WA), August 21, 1942; Surplus Property Board, Aluminum Plants and Facilities, 93.

78 “Aluminum—Have Or Have Not,” Fortune 28, no. 6 (December 1943): 38.
north of Spokane in Mead, Washington. Although the Interior Department argued for the DPC to build a handful of smaller alumina plants throughout the region, Alcoa and OPM favored the two larger facilities in order to speed production and for Alcoa to maintain power in the industry.\(^79\)

The Troutdale plant opened in 1942 with a capacity of more than 140 million pounds per year, costing the government nearly $19 million to construct. Originally slated to be run by Union Carbide and Carbon, the Mead reduction plant cost the government nearly $23 million and went into operation in May 1942, ultimately becoming the region’s largest producer of aluminum with six potlines and a capacity of more than 218 million pounds per year.\(^80\)

The Pacific Northwest’s alumina reduction plants tied the region into the global network of aluminum production. Refineries in East St. Louis; Mobile; Baton Rouge; Hurricane Creek, Arkansas; and Listerhill, Alabama received bauxite from Suriname and Arkansas, processed it into alumina, and sent the alumina to the sixteen reduction plants throughout the US, including the five located in the Northwest. The aluminum ingots produced in Oregon and Washington, amounting to forty-one percent of the nation’s total by 1945, then traveled back east to various fabrication plants. The aluminum sheet, extrusions, tubes, and other machined parts were then shipped throughout the country, but around two-thirds of it returned to the West Coast to aircraft factories, including to Boeing in Seattle.\(^81\) The War Production Board (WPB) became frustrated

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\(^81\) Bonneville Power Administration, *Columbia River Power and the Aluminum Industry*, 20; Surplus Property Board, *Aluminum Plants and Facilities*, 92-105; Letter to Dr. W.Y. Elliott, Director, Division of Stockpiling and Transportation, WPB, from H.F. McCarthy, Director, Division of Traffic Movement, WPB, December 31, 1943, Box 121, Moment Collection; Letter to Frank Knox from Harold Ickes, February 24, 1941; Box 2791; Department of the Interior, Office of the Secretary, Central Classified Files, 1937-1953; RG 48; NACP.
with these “wasteful joy rides of aluminum” which cost around $2.5 million per year, and worked with DPC, Alcoa, and the Interior Department to locate fabrication plants in the West.82

Bringing fabrication plants to the Northwest, and thus creating an integrated aluminum industry in the region, was one of the chief goals of Northwest planners within the NRPB and BPA.83 Ever the zealous advocate for Northwest development, Ickes brought up the need for an aluminum fabrication plant in the region for “national defense” purposes in a cabinet meeting in early 1941. Ickes secured agreement with Henry Kaiser for his company to operate the plant and convinced Secretary of the Navy Frank Knox to propose the plan to OPM.84 The plan, as it took shape in the first half of 1941, called for a fabrication plant in Fairview, Oregon, just east of Portland, along with several other smaller plants in the Northwest and Los Angeles. But OPM, likely influenced by Alcoa, reconfigured the plans in early 1942. Although construction had already begun on the Fairview plant, OPM moved it inland to Trentwood, Washington, east of Spokane, citing security concerns in the wake of the attack on Pearl Harbor. In addition, OPM consolidated the production planned for multiple facilities into the Trentwood plant, and contracted with Alcoa to operate that plant, although the War Department objected to the “consolidation on security grounds.”85

82 Taylor, “The White Elephant Comes Into Its Own,” 27; Letter to Frank Knox from Harold Ickes, February 24, 1941; Box 2791; RG 48; NACP.


84 Letter to Frank Knox from Harold Ickes, February 24, 1941; Letter to Harold Ickes from Frank Knox, February 27, 1941; Box 2791; RG 48; NACP.

Although the Trentwood rolling mill contributed to Alcoa’s monopoly, it also represented an important step toward an integrated aluminum industry in the Northwest. The Trentwood rolling mill cost the government more than $47 million to construct and began production in early 1943, making primarily sheet metal for aircraft. The mill received pig aluminum from one of the region’s five reduction plants, then shipped aluminum alloy sheet to Boeing in Seattle, numerous other airframe manufacturers in California, and subcontractors across the country building aircraft subassemblies. The factory had an annual capacity of 288 million pounds, making it, along with its twin plant in Chicago, the second largest producer of sheet aluminum in the nation.\footnote{Surplus Property Board, \textit{Aluminum Plants and Facilities}, 36, 61, 94; Carleton Green, \textit{Impact of the Aluminum Industry on the Economy of the Pacific Northwest}, A Report by Stanford Research Institute, Prepared for Aluminum Company of America, Vancouver, Washington (June 1954), 17; Boeing Aircraft Company, \textit{B-17 Production and Construction Analysis}, Prepared by: Air Materiel Command Headquarters, Los Angeles AAF Procurement Field Office, Industrial Planning Section, (May 29, 1946), 29-30, Boeing Company Archives, Bellevue, WA.}

Although an extrusion plant near Troutdale was proposed in 1942, the War Production Board moved the plant to Arizona, making the Trentwood rolling mill the sole aluminum fabrication facility in the Northwest constructed during the war.\footnote{“Aluminum Plant Lost to Oregon,” \textit{Seattle Journal of Commerce}, July 25, 1942; Bonneville Power Administration, Power Management Division, Market Development Section, “Arguments in the Extrusion Plant Controversy,” May 28, 1943, Box 248, Moment Collection.}

The development of the aluminum industry in the Northwest created new flows of commodities and capital that contributed to the diversification of the region’s economy and the rational use of the region’s resources as envisioned by regional planners. The region’s six aluminum plants introduced the Northwest to the global network of aluminum production, linking the region with South America, Greenland, and the southern United States. The industry also brought private and federal investment to the Northwest, totaling more than $95 million in
federal funds for infrastructure that continued to benefit the region after the war.\textsuperscript{88} The aluminum industry became BPA’s largest customer, generating more than $36 million in revenue for the agency over the course of the war. BPA provided the region’s six aluminum plants more than 16 million megawatt hours of electricity between 1939 and 1945, representing more than sixty-one percent of all BPA’s power sales.\textsuperscript{89} Luring the industry to the region proved a challenging feat for planners and Interior Department officials whose goals for long-term regional development often clashed with OPM’s mobilization plans and Alcoa’s desire to retain control of the industry. While OPM wanted as much aluminum as quickly as possible, the Department of the Interior sought rational growth of the industry that would make the best use of the Columbia River’s power and the region’s existing natural resources and industries. While the actual outcome of development represented a compromise of planners’ ideals, it nonetheless advanced many of their goals for the region and made an important contribution to the nation’s war machine.

\textbf{Plutonium Production at Hanford}

One of the Northwest’s most basic resources turned out to be essential to the most technologically sophisticated industry that emerged in the region during the war: plutonium production. Columbia River water and the power it generated were central to the decision to locate the Manhattan Project’s plutonium production facility in Washington State. On paper, this facility was just what regional planners hoped for. The project would use local resources in the construction and operation of the plant, purchase large quantities of BPA electricity, and serve as a major employer in a high-tech industry in a rural part of the state, helping to disperse industry

\textsuperscript{88} Surplus Property Board, \textit{Aluminum Plants and Facilities}, 12.

away from the region’s major metropolitan centers. But the Hanford Engineer Works was more than what planners had bargained for, yielding myriad unintended consequences that thwarted planners’ overall vision for the region. Hanford Engineer Works used Columbia River water to manufacture plutonium, creating jobs and contributing to the diversification of the region’s economy. But the work at Hanford also polluted the water and environment, resulting in profound and lasting changes that people continue to grapple with nearly a century later.

The quest for the United States to build an atomic bomb began in 1939 when President Roosevelt received a letter signed by Albert Einstein alerting him to the recent progress of physicists studying nuclear fission and its potential as a weapon. In response, Roosevelt immediately created the President’s Advisory Committee on Uranium, bringing together the nation’s top scientists to discuss fission research, particularly the problem of acquiring uranium, the key element used in nuclear fission. Over the next three years, as scientific advances continued, the government became increasingly involved in funding and coordinating fission research. By 1942, the science progressed to a point where the possibility of creating a nuclear weapon became feasible, so in August Roosevelt placed the research under the leadership of the Army Corps of Engineers, which established the Manhattan District to administer the research and development of an atomic bomb. The Corps of Engineers had two primary missions: to

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91 The Army Corps of Engineers districts were traditionally based on geographical regions, with the district named after the headquarters city. Col. James Marshall, the district’s first commander, initially established the headquarters in New York, thus Manhattan was the logical nomenclature, even though the district had no set geographical boundaries. Gen. Leslie Groves chose to retain the name after he assumed command, as it sounded less conspicuous than the Army’s initial name for the project: Laboratory for the Development of Substitute Metals. Robert L.
construct facilities to produce sufficient fissionable material and to build an atomic bomb with that material. To accomplish those missions, Brigadier General Leslie R. Groves, commander of the Manhattan District, had to figure out how to scale up the processes to create fissionable material and weaponize the fission reaction while those processes were still under development by scientists.

Preliminary research suggested that the newly-discovered element plutonium held the most promise as a fissionable material that could be produced in the quantities and timeframe needed for the weapons program. Identified in 1940 by chemist Glenn Seaborg, plutonium is a man-made element created by irradiating uranium with an isotope of hydrogen. Plutonium offered advantages over uranium as a fissionable material since separation of the fissionable isotope of uranium, uranium-235, required massive amounts of uranium ore, whereas plutonium production utilized uranium-238, the most prevalent isotope. Groves initially planned to construct a test plutonium production reactor in a forest preserve outside of Chicago and the full-scale reactors at the Manhattan Project site in Oak Ridge, Tennessee. But as research and planning progressed, it became clear that the plutonium production facility would require more space and more electricity than the Oak Ridge site could provide. In addition, DuPont, the contractor selected to construct and operate the plutonium production plant, was “greatly concerned about the hazards of manufacturing plutonium on a large scale.”


Jones, Manhattan, the Army and the Atomic Bomb, 108.
explained, “we could not afford to spend time on the research and study that would have been necessary to make certain that the operation…would be safe.”

To mitigate the possible harmful effects of the untested technology, Groves and DuPont sought a remote, isolated location so that if an accident occurred or the process went awry, the impact on the local population would be minimal. In December 1942, Manhattan Project personnel developed criteria for the new plutonium site. The requirements included: an area of twelve by seventeen miles no closer than twenty miles to the nearest town; railroad and highway access, but with the main line no closer than ten miles away; relatively flat, open, and seismically-stable land with a mild climate; access to a water source that could supply 25,000 gallons per minute of fresh water to cool the reactors; and access to 100,000 kilowatts of electricity.

Given these criteria, the West seemed the most likely suitable location, so Groves dispatched Col. Franklin Matthias and two engineers from DuPont to survey prospective sites. On December 22, the team surveyed a site northwest of Pasco, Washington. Matthias recalled that “I thought that the site was perfect the first time I saw it…. It had so much in favor of it. An area with almost no people, fairly undeveloped. It just ha[d] all of the advantages.” The site was situated south of the Columbia River, which could provide more than enough water; had


easy access to a railroad line; had advantageous topography in its flat, sandy landscape; was near the BPA’s Midway substation, which transmitted power from Bonneville and Grand Coulee Dams; and the land appeared undeveloped and of low value. Matthias and the survey team reported that the land was “practically worthless… It is apparent that the man who named [the nearby town of] Richland was a wag.” Groves concurred with his team’s assessment after his own visit on January 16, 1943. In his memoir, Groves recalled that “most of the area was sagebrush suitable only for driving sheep…. The total population was small and most of the farms did not appear to be of any great value.” Having identified the “perfect” location, Groves approved the site and on February 8, 1943, the Secretary of War authorized the acquisition of the land.

Although Matthias and his colleagues noted in their site report that the area was “known locally as ‘scab-land’ and considered of no value,” nearly three thousand people lived and farmed in the Priest Rapids Valley. The Wanapum had lived in the Priest Rapids Valley for thousands of years and continued to practice their traditional lifeways, relying on hunting, gathering, and fishing for salmon in the Yakima and Columbia Rivers for subsistence. Beginning in the late nineteenth century, the promise of irrigation drew farmers to the Priest

97 Bogen, Peterson, and Matthias, “Site Notes Site Requirements.” Richland was actually named after one of the early settlers, Nelson Rich, rather than as a hopeful testament to the potential prosperity of the area, as the surveyors seemed to think. Jim Kershner, “Richland—Thumbnail History” in HistoryLink.org Online Encyclopedia of Washington State History, https://historylink.org/.

98 Groves, Now It Can Be Told, 75.


Rapids Valley to take advantage of its sunny climate and rich soil. Settlers built a few small irrigation systems to supplement the meager eight inches of annual precipitation, but hoped for government funding to construct a more effective, large-scale system. The microclimate of the valley gave local farmers the advantage of a longer growing season than in other areas of the state. Farmers grew food for their families as well as cash crops including alfalfa, apples, apricots, asparagus, cherries, grapes, hay, mint, peaches, and strawberries. Many farmers also grazed cattle and sheep and kept dairy cows and poultry. The state of Washington even established a small veterans’ resettlement project in the Priest Rapids Valley, providing farms and equipment at low cost to World War I veterans. The towns of Hanford, Richland, and White Bluffs emerged to provide for the commercial needs of the farmers and the railroads that traversed the valley.

The Great Depression hit the area hard and many farmers abandoned their property. New Deal planning and programs sought to help the region’s farmers by finally bringing reliable irrigation water to the Priest Rapids Valley and larger Columbia Basin, as proposed in the Corps

101 As in many cases across the West, privately-funded irrigation systems proved insufficient or the capital to construct the projects never materialized, so boosters turned to the government for help. In the case of the Priest Rapids Valley, capitalists in Seattle, New York, and Boston, including the General Electric Company, sought to develop hydropower and irrigation systems in the area in the first decades of the twentieth century, but these plans never came to fruition. “Huge Struggle to Control Water Rights,” Seattle Times, November 10, 1909; Martha Berry Parker, Tales of Richland, White Bluffs, and Hanford 1805-1943 (Fairfield, WA: Ye Galleon Press, 1979), 254-256; DuPont, Construction Hanford Engineer Works, History of the Project, Volume I [Sec 1 of 2], (Wilmington, DE: E.I. DuPont de Nemours & Company, Inc., August 9, 1945), 4, 6; Document Number HAN-10970-VOL1; DRRS Accession Number D198177673; DOE Reading Room.


of Engineers’ 308 Report. Although the war put the construction of irrigation systems on hold, regional planners still intended the Columbia Basin to become a “new frontier”: “we are planning an empire for Johnny Doughboy to start building as soon as he arrives home,” Harold Ickes announced in 1943. But instead of becoming part of the new “empire” described by Ickes, Priest Rapids Valley residents received letters in March of 1943 notifying them that the government required their land and they had thirty days to leave.

Historian Kate Brown describes Matthias’ selection of the Priest Rapids Valley and eviction of its residents as “a merciful gesture. Matthias had come as an ‘un-founding father’ to the luckless communities he selected for removal.” She claims the residents were “paralyzed and passive” in the face of the government’s takeover of their land. Such a depiction does a disservice to the local people and their environment, perpetuating tired stereotypes about the arid West. The communities were not luckless, paralyzed, or passive. Although farmers had struggled through the Great Depression, New Deal programs like the Agricultural Adjustment Act and Rural Electrification Administration provided relief in the form of farm loans and access to electricity. By the early 1940s, farm productivity had increased and commodity prices rose due to the expanded market for food as the war escalated. Indeed, farmers in the Priest Rapids

107 Although Brown’s book won wide acclaim, the author seems to makes little attempt to understand the point of view of her historical subjects. Instead, her descriptions reflect the language of the Manhattan Project outsiders, emphasizing the most alien aspects of the region’s environment and downplaying the agency of local people. Furthermore, Brown editorializes based on her own unfavorable impression of the area, declaring that “the nuclear reservation is just not that impressive,” 21.
Valley enjoyed some of their best harvests and returns in the early 1940s.\textsuperscript{108} The farms, river, and landscape had important meaning to the settlers and to the Wanapum, who still lived in the Priest Rapids Valley or traveled to the area seasonally to fish.\textsuperscript{109} Residents were not waiting to be relieved of the burden of their farms; they were waiting for the irrigation water promised by the federal government. Far from being paralyzed and passive, local residents pushed back against the War Department’s seizure of their property.

Although residents reluctantly agreed to leave for the good of the war effort, they were not willing to accept the appallingly low payments offered by the War Department for their property. War Department officials successfully pressured many owners into selling their properties for pennies on the dollar, sometimes even through strong-arm tactics including threats and questioning owners’ patriotism.\textsuperscript{110} Residents soon contacted a local attorney who advised them not to accept the government’s initial offer. Most wartime seizures of property proceeded quickly and smoothly, taking an average of four days from request to acquiring title to the land.\textsuperscript{111} But in the case of Hanford, the process took more than four years.

Nearly two-thirds of property owners challenged the War Department’s initial offers. Every resident who challenged the government’s appraisal, either through negotiations or in federal court proceedings, received higher compensation for their property. For example, the War Department initially assessed one farmer’s orchard land at $6,500. Through negotiation and


\textsuperscript{110} Ruth Gahnberg, “Use of Pressure Charged In Hanford Land Seizures,” \textit{Seattle Times}, December 18, 1944.

\textsuperscript{111} Department of Justice, \textit{Public Lands and National Treasures: The First 100 Years of the Environment and Natural Resources Division} (Washington, DC: Department of Justice, 2009), 28-29.
reassessment, he received $32,00 for his property. Another farmer “point blank refused to accept the [War Department’s] offer” of $12,500 for his home and orchard. After the Department of Justice reassessed his property in the fall of 1944, along with the more than seven hundred remaining disputed properties, he accepted the new offer of $19,000. By December 1944, more than seventy cases had gone to jury trial at the federal court in Yakima. In one case, the jury awarded a veteran farmer $7,400, more than double the initial appraisal. The process became such a scandal that the *Seattle Times* ran a four-part investigative series on the issue in December 1944. When those articles appeared, more than a year and a half after residents were ordered to leave, more than thirty-two percent of tracts had not been settled yet. Ultimately, the federal government spent more than five million dollars acquiring around 500,000 acres of land. The legal acquisition process continued beyond the end of the war, and displaced residents and Manhattan Project officials remained bitter about the process for years after.

Construction of the Hanford Engineer Works (HEW) began almost immediately upon the removal of residents from the land in early 1943, transforming the Priest Rapids Valley from farms and desert into a dispersed high-tech manufactory. Construction of the facility was an immense and complex process that presented a number of challenges to the Corps of Engineers,

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113 In the first article of the series by Ruth Gahnberg, a banner headline splashed across the top of the December 17, 1944 *Seattle Times*: “Ousted Owners Demand Investigation of Hanford Land Seizures.”


DuPont, and their subcontractors. Some of the same environmental factors that made the site appealing also made the construction process more difficult. Contending with the isolation of the site, need to maintain secrecy, lack of local manpower, scarcity of materials, untested and constantly changing design, detailed specifications with little margin of error, the size of the facility, and the short time frame in which to get the facility operational made the construction of HEW one of the most complex projects undertaken by the Corps of Engineers during the war.  

Engineers arranged the structures within the nearly 500,000 acre reserve according to function and safety concerns, situating the production facilities as far away from residential areas as possible. The “process area” of the site contained three production reactors (known as the 100 Areas), two chemical separation plants and one storage plant (200 Areas), and a test reactor and uranium fuel production plant (300 Area). Along with the main production buildings, each process area also included numerous ancillary structures and elaborate water filtration and pumping systems. For safety purposes and to be close to the water necessary for the functioning of the plants, the 100 Areas were located along the Columbia River at the far north end of the reserve, each six miles apart from each other and around thirty miles away from the nearest towns of Richland, Pasco, and Kennewick. Engineers selected the former townsite of Hanford as the location of the construction camp and Richland for the permanent workers’ village. The entire project comprised more than 500 non-residential structures, 386 miles of roadway, 158

116 US Army Corps of Engineers, *Manhattan District History, Book IV - Pile Project X-10, Vol. 5 - Construction* (December 22, 1945), S2, S3, 1.4, 4.1; Document Number IN-4421; DDRS Accession Number D0825958; DOE Reading Room.
miles of railroad track, and more than 50 mile of power lines. To get the project operational in time required the labor of thousands of workers and massive amounts of building materials.\textsuperscript{117}

Although the isolation and sparse population was essential for the safety and security of the Hanford project, those factors, combined with the desert environment, made attracting and retaining workers challenging. Employees had to be recruited from beyond the Northwest so as not to draw workers away from the critical war industries in the Seattle-Tacoma and Portland metropolitan areas. Ads appeared in newspapers across the country promising that workers could “enjoy the thrill of a new, important job. Get acquainted with the Pacific Northwest. Know the adventure of being an important part in America’s fight.”\textsuperscript{118} Recruits were not told what the project was, except that “this project [is] rated by the Army, Navy and War Manpower Commission as EXTREMELY IMPORTANT to your country.”\textsuperscript{119} The need for secrecy made it difficult to recruit and retain workers. Indeed, departing employees often cited the seeming lack of connection of their work to the war effort as a reason for quitting. As Hanford employee Lois May Lyon put it, in verse: “It’s just that I want to be doing/A thing I can see and know/Be it a ship or airplane or what not./The thing is I just want to know.”\textsuperscript{120} The vast majority of Hanford employees never knew the true purpose of their work until President Truman released the information about the Manhattan Project on August 6, 1945, the day of the bombing of


\textsuperscript{118} Display ad, \textit{Chicago Tribune}, November 15, 1943, 14.

\textsuperscript{119} Ibid.; Display ad, \textit{Chicago Tribune}, July 5, 1944, 8. Emphasis in original.

\textsuperscript{120} Quoted in Ted Van Arsdol, \textit{Hanford, the Big Secret} (Vancouver, WA: T. Van Arsdol, 1992), 19.
Hiroshima. As Richland’s newspaper, *The Villager*, reported, “to nearly everyone the news of what Richland was helping to make came as a complete surprise.”

Isolation and the local environment proved formidable obstacles to worker retention. The Corps of Engineers explained that, “the adverse effects of arid summers, high temperatures from 110F to 80F, prevalence of strong winds and frequent dust storms, isolation from large cities, and lack of family quarters near the Project conspired to reduce employment at Hanford and increase the difficulties of maintaining an adequate workforce.” Indeed, the dust storms became so notorious for prompting people to quit that they became known as “termination winds,” and the dust itself nicknamed “termination powder.” To keep employees on the job, DuPont offered incentives such as reimbursement for railroad fare to and from Pasco after seven months of satisfactory work; the construction of “community facilities,” including recreation halls, theaters, bowling alleys, and a library, within the temporary construction camp and permanent village at Richland; and recreational opportunities including baseball games, dances, and an air show.

Over the course of the war, more than 262,000 people interviewed for jobs at HEW and 94,307 were hired. Worker population peaked at 45,000 in May 1944 and fell to 10,000 by September 1945 when construction was complete and the project operational.

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121 *The Villager* (Richland, WA) August 6, 1945, Box 84759 4 of 12, Folder 1, Hanford History Project.


Local environmental factors were an important consideration for engineers and architects both in siting HEW in the Priest Rapids Valley and in methods of constructing the massive facility. Engineers devised ways to use local building materials as much as possible in order to expedite construction on the remote site, and work within the War Production Board’s material priorities and policy of “favoring local suppliers.” Wood and concrete became the most widely used building materials for the project. Both materials could be obtained on-site or within the region, were relatively inexpensive, and had favorable properties appropriate for their applications within the project.

The construction of Hanford required around 160 million board feet of lumber, equivalent to 135 acres of timberland. Much of the lumber was used for housing and community structures in the construction camp at Hanford and in the permanent village in Richland. The construction camp consisted of 195 wood-frame barracks built on-site and 660 prefabricated plywood huts built in Seattle and transported to Hanford. In addition, seven trailer camps provided space for 3,639 trailers, accommodating construction workers who traveled with their families. In contrast to the “Wild West” character of the construction camp, DuPont intended the workers’ village to provide a familiar, middle-class-style town for the operators of the plant who would live there full-time. Designed by Spokane architect G. Albin Pherson, the houses in Richland were a combination of single-family homes and duplexes based

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126 Ibid., 1.5.
127 Ibid., 7.8-7.11.
on a handful of designs. Residents dubbed the structures “Alphabet Houses” as each design was
designated by a letter, A through H, and L. In addition to the 2,500 Alphabet Houses, residences
also included 1,804 prefabricated single-family homes and 25 dormitories.128 All structures
except the prefabs were wood frame construction built on-site from lumber cut and milled in
western Oregon and transported to the site on barges along the Columbia River. Construction of
the prefabs took place at a plywood mill in Toledo, Oregon, using 10 million square feet of
plywood. The houses were partially furnished with plywood furniture and then trucked to
Richland.129 Utilization of wood construction enabled engineers to take full advantage of local
resources as well as to facilitate rapid construction.

Concrete was the most widely used building material for the production facilities at the
site. Indeed, the availability of aggregate was an important factor in locating HEW in the Priest
Rapids Valley. Workers built two aggregate plants and five concrete plants on site to turn the 25
million cubic yards of earth excavated at the site into the 780,000 cubic yards of concrete and 1.5
million concrete blocks used in the construction of production buildings.130 Each of the three
reactors alone required 27,400 cubic yards of concrete, 50,000 concrete blocks, and 71,000

128 The Alphabet Houses were all built on-site. Letters J-K were designated for dormitories. Letter I was intended for
one-bedroom apartments, which were not built and instead replaced with prefabs. The prefabricated houses were
built in Oregon, based on plans prepared by the Corps of Engineers and Tennessee Valley Authority, and transported
to Richland. DuPont, Construction Hanford Engineer Works, History of the Project, Volume I [Sec 1 of 2], 106,
108-111; DuPont, Construction Hanford Engineer Works, History of the Project, Volume I [Sec 2 of 2],
(Wilmington, DE: E.I. DuPont de Nemours & Company, Inc., August 9, 1945), 115; Document Number HAN-
10970-VOL1; DDRS Accession Number D198177685; DOE Reading Room; DuPont, Construction Hanford
Engineer Works, History of the Project, Volume 4 (Wilmington, DE: E.I. DuPont de Nemours & Company, Inc.,
August 9, 1945), 1242, 1245; Document Number INDC-356-VOL4; DDRS Accession Number D196050403; DOE
Reading Room; US Army Corps of Engineers, Manhattan District History, Book IV - Pile Project X-10, Vol. 5 -
Construction, 9.42-44; Ferguson and Smith, Something Extraordinary, 74-75.

129 “Ten Million Feet By Barge and Truck,” The Timberman (December 1943): 10-11, 90; “Plywood Aid to Atom
Bomb,” n.d., Scrapbook 2015.001.019, Box 6, Hanford History Project.

130 US Army Corps of Engineers, Manhattan District History, Book IV - Pile Project X-10, Vol. 5 - Construction,
1.4.
concrete bricks to build. Each chemical separation plant used between 79,000 and 90,000 cubic yards of concrete and 500 concrete blocks.\textsuperscript{131} Concrete was not only a readily-available resource, but functioned as a barrier to shield workers from the radiation emitted deep within the reactors and separation plants.

The construction of the Hanford project relied upon a variety of resources found within the region and imported from across the nation. The operation of the Hanford project, however, relied primarily upon one local resource: water. The Columbia River served as the foundation for the entire plutonium manufacturing process at Hanford. The Columbia River provided water to cool the reactors and irradiated uranium and plutonium, and provided electricity to power the myriad monitors, controls, and mechanisms necessary in the production process. The very basic element of water became essential to the very cutting-edge technology developed at Hanford during the war.

The method for creating plutonium from uranium at Hanford involved three steps: preparation of uranium fuel, irradiation of the uranium, and chemical separation of the plutonium from the uranium and other materials. The manufacturing process established new flows of materials between Hanford, the other Manhattan Project sites across the country, and sites of extraction of raw materials. Uranium used at Hanford during World War II was mined in the Belgian Congo or Canada, and refined and processed into pure metal in facilities throughout the Midwest.\textsuperscript{132} Uranium arrived at the 300 Area at Hanford via railroad in the form of rods or,

\textsuperscript{131} DuPont, \textit{Construction Hanford Engineer Works, History of the Project, Volume II} (Wilmington, DE: E.I. DuPont de Nemours & Company, Inc., August 9, 1945), 810, 908; Document Number INDC-356VOL2; DDRS Accession Number D196048660; DOE Reading Room.

beginning in early 1945, as billets that workers extruded into rods on-site. Workers then cut the rods into smaller “slugs,” either 4 or 8 inches long with a diameter of 1.5 inches. To prevent seepage of radioactive material into the reactor’s cooling water and to prevent the water from corroding the uranium, the slugs were encased, or “canned,” through a series of baths in a jacket consisting of layers of bronze, tin, and finally an aluminum-silicon alloy. The crafting of uranium fuel slugs was an exacting and precise process with little to no margin for error. After passing inspection, the fuel slugs continued on to the reactors in the 100 Areas.

Hanford Engineer Works contained three reactors: B, completed in September 1944, D, completed in December 1944, and F, completed in February 1945. The three reactors were identical in design and essentially scaled-up version of Enrico Fermi’s experimental reactor built at the University of Chicago, but 500 million times more powerful. B Reactor, the first to commence operation, was contained within a large reinforced concrete building and sat atop a 23-foot thick concrete foundation. The reactor itself consisted of 100,000 graphite blocks, 5 inches square and around 40 inches long, painstakingly stacked and arranged in a cube and surrounded by 8 to 10 inches of cast iron thermal shielding. The whole reactor measured approximately 35 feet high, 40 feet wide, and 31 feet from front to back. Operators were


protected from the radiation within the reactor by several layers of steel, masonite, and concrete shielding up to five feet thick. Aluminum-lined tubes, made of aluminum provided by Alcoa, passed through the graphite reactor in a grid pattern. 2,004 horizontal process tubes accommodated fuel slugs and cooling water from the front of the reactor, while boron control rods were inserted and removed from the left side of the reactor, and safety rods inserted and removed from the top.\textsuperscript{136}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{image.png}
\caption{Hanford workers laying up the graphite core of the B Reactor, 1944. HAER WA-164-7, Historic American Buildings Survey/Historic American Engineering Record/Historic American Landscapes Survey, Prints and Photographs Division, Library of Congress.}
\end{figure}

\begin{itemize}
\item Landmark Nomination Form, 5, 24. Later sources give the reactor dimension as thirty-six feet high, thirty-six feet wide, and twenty-eight feet front to back. Gerber and Casserly, “B Reactor,” National Historic Landmark Nomination Form, 4; Gerber, The Plutonium Production Story at the Hanford Site, 2-1.
\end{itemize}
To operate the reactor, workers loaded 200 tons of fuel slugs into the process tubes. Then workers, using remote controls, withdrew the safety rods and control rods. The graphite of the reactor and boron of the control rods absorbed neutrons, so when removed, the critical mass of uranium fuel slugs initiated a fission reaction. The neutrons released during fission of the uranium-235 transformed the isotope uranium-238 into plutonium-239. Fission in Hanford’s reactors generated around 250 million watts of energy, which also produced heat. Water running through the process tubes cooled the reactor. Scientists monitored the progress and controlled the reaction by reinserting and removing control rods as needed. The fuel slugs “cooked” for around 100 days, depending on their location within the reactor. Physicists calculated when each slug was complete, and then workers using remote mechanisms pushed the slugs out the back of the reactor and into 20-foot deep cooling pools. After cooling for around 60 days, but sometimes as few as 21 days, workers transported the irradiated slugs to one of the chemical separation plants in the 200 Areas.137

Water played an essential role in the plutonium production process by cooling the reactors. The availability of fresh, cool water from the Columbia River to reduce the temperature within the reactors was an important factor in selecting the Hanford site.138 Hanford’s reactors were single pass reactors, meaning that water was pumped through the reactor once and then discharged. Each reactor used 30,000 gallons of water per minute, totaling 1.29 billion gallons of

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138 When the Corps of Engineers selected the Hanford site in early February 1943, scientists were still debating whether to use helium or water to cool the planned reactors. Soon after Hanford was selected, scientists and the Corps of Engineers decided to proceed with the water-cooled design, thus reinforcing advantages of the Hanford site. Groves, Now It Can Be Told, 80-81.
water per day for all three reactors by 1945. Large pumps drew water directly from the Columbia River and through a series of filters to remove sediment and minerals. Then the water was chemically treated to prevent corrosion of the process tubes. Thousands of tiny nozzles pumped the treated water through each process tube. The water entered the tube at 50 degrees Fahrenheit and exited the back of the tubes at 140 degrees, absorbing heat from the fission process. While in the reactor, the cooling water became “activated” as trace elements in the water reacted to the fission process. The water, both literally and figuratively hot, was pumped from the reactor to two large outdoor concrete-lined retention basins, each with a capacity of six million gallons. Water cooled in the basins for around thirty minutes to six hours, which allowed the temperature to reduce and the radioisotopes to decay to a safer level. Once cool, the water was pumped back into the Columbia River, through pipes that discharged the water into the middle of the river to allow for dilution. As General Groves later stated, “we were certain the dilution would ensure the safety of the human population downstream.”

Columbia River water was essential to the operation of Hanford’s reactors. If the flow of water stopped for even a moment and the automatic safety mechanisms in the reactor failed, scientists explained that “the pile reaction may then accelerate itself so rapidly that disaster of catastrophic proportions may result almost immediately.” Consequently, engineers designed

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140 Gephart, A Short History of Hanford Waste Generation, Storage, and Release, 3-4; Williams, Made in Hanford, 97; Gerber, The Plutonium Production Story at the Hanford Site, 2-2.
142 Groves, Now It Can Be Told, 82.
143 Health and Medical History Hanford Engineer Works, 4; Accession Number 13537, DOE Reading Room.
two backup systems for the reactors’ water supply. The numerous pumps and mechanisms that brought the water from the river through the reactors relied on BPA power. If that power failed, a coal-fired steam generator plant at each 100 Area would power the pumps. The “last ditch” backup system consisted of a series of water towers located in the 100 Areas, each containing 30,000 gallons of water, that could be released and run through the reactors by gravity.\textsuperscript{144} The first backup system only deployed one time, when a Japanese balloon bomb became entangled in BPA transmission lines south of Hanford and cut off power momentarily. The steam generator kept the water flowing through the reactors, preventing them from overheating.\textsuperscript{145}

![Aerial view of the 100-B Area, looking northwest, 1945.](image)


The final step in plutonium production at Hanford took place in the chemical separation plant in the 200 Area. Irradiated slugs went through a series of baths using a variety of chemicals to isolate the plutonium from the uranium and other chemicals created in the fission process. The separation process generated around 8,000 gallons of highly toxic chemical waste for each metric ton of fuel slugs used. The first batch of plutonium delivered to the Army on February 2, 1945 consisted of 80 grains of plutonium “separated and isolated from approximately 3.1 metric tons of uranium metal.”

The plutonium made in Hanford powered the world’s first nuclear bomb, the Trinity test bomb, as well as the atomic bomb dropped on Nagasaki on August 9, 1945.

Plutonium production at Hanford Engineer Works had destructive consequences abroad and mixed results in the Northwest. The creation of HEW both advanced and defeated many of

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the regional planners’ visions for the region. Regional planners would have been pleased by Hanford’s efficient use of local resources in construction of the site, had they been privy to its existence. The project relied on water from the Columbia River both to cool reactors and to power the entire site. Hanford proved BPA’s first administrator, J.D. Ross, correct when he argued that surplus power capacity would attract industry to the region. The project became a major customer of BPA power, taking advantage of the integrated transmission system built in the late 1930s. Hanford also fulfilled planners’ goals to diversify the region’s economy and disperse industry throughout the region beyond the Seattle-Tacoma and Portland metropolitan areas by bringing a new high-tech industry to a rural part of Washington. However, the planning and construction of HEW was done in secret and in haste, without the input of local planners or residents. The project subverted plans for the area and disrupted the lives and livelihoods of local people. It removed thousands of acres from the planned Columbia Basin Project, decreasing present and future agricultural production. The plutonium production process generated myriad toxic and radioactive wastes. Du Pont and the Corps of Engineers sacrificed the environment to the pressures of war, choosing the most expedient and basic means of waste elimination: dilution in the air and water and burial underground. Certainly such long-term spoliation of the environment did not align with regional planners’ conservation ethic.

Conclusion

The Columbia River played a critical role in industrial mobilization in the Pacific Northwest during World War II. The construction of Bonneville and Grand Coulee Dams and a regional power transmission system as part of the New Deal provided the infrastructure necessary for the region to respond to the military’s wartime demand for weapons and materiel. Planners and government officials leveraged the Northwest’s resources, especially surplus
electrical power, to attract industries to the region. The industries that grew in the Northwest to take advantage of BPA power established new flows of capital and commodities throughout the region. Industries like shipbuilding, aircraft manufacture, aluminum processing, and plutonium production brought millions of federal dollars worth of industrial infrastructure investment into the region. They also linked the Northwest to global networks of materials, like bauxite and uranium, while exporting finished products throughout the United States and the world. These industries fulfilled many New Deal-era regional planners’ goals for the Northwest by utilizing the region’s natural resources, particularly hydropower, and diversifying the economy beyond extractive industries.

The economic and environmental effects of the aluminum and plutonium production industries lasted beyond the war. The aluminum industry represented a success for regional planners, as the most logical industry to grow from the hydroelectric power development of the Columbia River. Deliberately established in the region through the painstaking efforts of Interior Department officials, the aluminum industry largely lived up to planners’ goals. The federal government, through the Defense Plant Corporation, spent millions of dollars constructing aluminum production facilities throughout the Northwest that continued to benefit the region after the war. By bringing in new companies to produce aluminum, the Department of the Interior successfully broke Alcoa’s monopoly on the industry. Reynolds and Kaiser purchased surplus plants in the Northwest after the war and continue to operate them today.148 Hanford, on

the other hand, was essentially the “unintended offspring” of the campaign for hydroelectric power development on the Columbia River. While Hanford represented a victory for planners as a high-tech industry in a rural part of the region, the unintended consequences of plutonium production certainly were not what planners had envisioned for the region. Plutonium production expanded during the Cold War and finally ceased at Hanford in 1990. Since then, the federal government has spent billions of dollars cleaning up the toxic waste left behind. Department of Energy officials estimate the clean-up efforts to cost up to another $640 billion and continue until at least 2078.

Figure 7. War Projects Served by BPA Power, 1944. Lillian Davis, “The Bonneville Power Administration and the War,” unpublished manuscript, July 31, 1944, BPA Library.


CHAPTER TWO

“WOOD IS A WAR WEAPON”:

THE NORTHWEST FOREST PRODUCTS INDUSTRY

Introduction

Early in the morning of September 9, 1942, Japanese submarine I-25 surfaced off the coast of Southern Oregon. On its deck, sailors assembled a Yokosuka E14Y floatplane and launched it with a catapult. Pilot Nobuo Fujita flew toward Cape Blanco lighthouse on the Oregon coast with a payload of two 170-pound incendiary bombs. His mission: to set Northwest forests on fire to create panic, to draw resources away from war production and the US Navy’s operations in the Pacific, and to retaliate for the Doolittle Raid on Tokyo earlier that year. About fifty miles southeast of Cape Blanco, Fujita released the bombs, and returned to sea to rendezvous with the I-25. Soon after the bombs detonated, fire lookouts in the Siskiyou National Forest spotted smoke plumes rising from the forest east of Brookings. Fire crews on the ground eventually located the site, extinguished the fire, and recovered parts of the bombs that had not been destroyed in the explosion. Fujita returned on September 29, dropping two more incendiary bombs in the forest east of Port Orford. But Fujita’s mission failed. Due to the unusually rainy weather in Southern Oregon that September, the forest was not as dry as it normally was in the late summer, so the fires ignited by the incendiary bombs did not result in the dramatic

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conflagration predicted by Japanese naval planners. Fujita’s two bombings marked the only direct enemy attack on the continental United States during the war. The planning and resources put into these attacks, and the balloon bombs launched later in the war, demonstrate that the Japanese understood the importance of Northwest forests to the Allies.

The forests of the Pacific Northwest provided valuable resources for the Allied war effort. The nearly 53 billion board feet of lumber harvested in Oregon and Washington between 1941 and 1945—one third of the nation’s wartime production—built ships, aircraft, factories, cantonments, housing, railroad cars, and crates and boxes to transport weapons and materiel across the globe. The lumber industry was extremely important to the region. Since the late nineteenth century, the industry dominated the Northwest economy and by 1940 remained the second largest employer in the region, behind agriculture, employing more than 120,000 people in Washington and Oregon. Military and regional planners expected Northwest forest products

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3 Nobuo Fujita’s connection to Oregon continued after the war. In 1962, women of the Brookings Junior Chamber of Commerce invited Fujita to the city’s Azalea Festival as an expression of goodwill. Fujita and his family returned for the festival and presented the city with his family’s samurai sword as a gesture of peace and reconciliation. Fujita and his family visited Oregon several more times and hosted Oregonian youth in Japan before his death in 1997. For more on Fujita’s visits to Oregon, please see John Rosman, “The unlikely bond between an Oregon town and the man who bombed it,” Oregon Public Broadcasting (December 7, 2016) https://www.opb.org/artsandlife/series/history/nobuo-fujita-brookings-oregon-world-war-2/. For more on the Japanese balloon bombs, please see Bert Webber, Retaliation, and Ross Allen Coen, Fu-Go: The Curious History of Japan’s Balloon Bomb Attack on America (Lincoln: University of Nebraska Press, 2014).


to play an important role in the war effort. But how would war mobilization effect the region’s forests and associated industries?

The war emerged during a transition period in the lumber industry in the Pacific Northwest, from the “cut and run” practices of the nineteenth century to more sustainable harvesting and forestry practices that would promote the longevity of the industry in the region. The lumber industry was also experiencing a technological shift, with diesel-powered trucks, tractors, and saws beginning to replace traditional human, animal, and steam-powered tools and equipment. Similarly, the policies of the Forest Service and National Park Service under the Franklin D. Roosevelt administration represented the climax of the conservation movement as it transitioned into the environmental movement in the postwar era. The war created an insatiable demand for forest products, but in the Northwest, the scale of extraction was not as great as it could have been. Instead, a strong federal commitment to conservation policies, and technological and manpower limitations due to the war prevented the lumber industry from exploiting the region’s forests in the name of war production.

**Historical Context**

From its inception, the lumber industry in the United States operated under the fallacy that the nation enjoyed an unlimited supply of timber. As the United States expanded across the continent from the East Coast in the late eighteenth and early nineteenth centuries, Euro-Americans saw forests as dangerous and their highest use as a supplier of building materials. Americans sought to transform forests into farmland, “‘to get the land subdued and the wilde nature out of it,’” as one early settler in Washington put it, and use the wood to build homes,
barns, fences, and wagons. Logging proceeded across the country driven by the demand for lumber and farmland, and limited only by the physical ability to harvest timber and transport it to markets. Once loggers cleared an area of trees, they moved on to a new stand. This process of cut-and-run repeated itself in successive waves as lumbering shifted from New England to the Great Lakes states in the 1860s, and to the South and Pacific Northwest in the 1880s. As William Greeley, Chief of the Forest Service, explained in 1925, “cheap stumpage has led [the lumber industry]—north, south, and west—with always a frontier of forest wilderness to fall back upon when the immediate supply should be exhausted.” The Pacific Northwest became that “frontier” for the lumber industry, drawing the industry west as the forests in the Midwest became depleted by the end of the nineteenth century.

Environmental and economic conditions in the Pacific Northwest disrupted the pattern of cut-and-run as the lumber industry expanded in the region in the late nineteenth century. The composition of Northwest forests along with the region’s topography and climate proved formidable obstacles to the lumber industry intent upon clearing the region’s forests. The forests of western Washington and Oregon were extremely dense environments, with Douglas-fir, Sitka spruce, western hemlock, and western redcedar providing the highest volume of timber in the United States. Douglas-firs, the largest and dominant species in Northwest forests, grow as high

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7 Williams, *Americans and Their Forests*, 193, 289.

as three hundred feet tall and twenty feet in diameter, and can live to more than one thousand years.\textsuperscript{9} By contrast, eastern white pine, the dominant species in the Midwest and East Coast lumber industry, grow between one hundred and two hundred feet tall, with a trunk diameter of eight feet, and live up to five hundred years.\textsuperscript{10} Similarly, the topography of the Northwest differed significantly from the relatively flat Midwest. Much of the region’s timber grew within vast mountain ranges, making trees difficult to access and remove. Climate also proved an impediment to logging. While Midwestern loggers could skid felled logs along frozen streams in the winter, loggers in the Northwest had to contend with as much as two hundred inches of precipitation per year, resulting in muddy quagmires on the forest floor. The sheer size of trees, density of forests, topography, and climate made it nearly impossible for loggers to replicate the process of extraction that they employed in the east.\textsuperscript{11}

Over the course of the late nineteenth and early twentieth centuries, loggers devised various techniques and technologies to contend with the Northwest environment. When commercial logging began in the mid-nineteenth century, most cutting took place in the lower-lying forested areas directly adjacent to major waterways to facilitate transportation. Mills sprang


up around Puget Sound and the region’s major rivers to process the lumber logged from the nearby forests. Early logging was extremely wasteful. Loggers left stumps as high as twenty feet because the bark at the base of Douglas-firs was so thick and the tree so full of pitch it was extremely difficult to cut. Tree limbs, tree tops, diseased trees, and any trees that broke apart upon impact were left to rot. This “slash” left on the forest floor became a fire hazard and hindered reforestation or the use of cutover lands for farming or other purposes.12

As the coastal forests were cut over, loggers moved further inland and implemented a variety of strategies to move logs from forest to mill. Rather than using oxen to pull logs across frozen streams as loggers did in the Midwest, loggers in the Northwest built “skid roads” (roadways paved with logs), then replaced oxen with “steam donkeys” to pull logs and built logging railroads into the forest to replace skid roads. Loggers also devised new felling techniques and began using large circular saws in the mills to accommodate the large, old-growth trees. The crosscut saw and double-bitted axe, along with the donkey engine, high-lead yarding, and logging railroad were the primary tools used to extract logs from Northwest forests from the 1880s until World War II.13 Adaptation to the new environmental conditions encountered in the Northwest took time, preventing the same degree of wholesale forest destruction from happening in the Northwest as rapidly as it had in other regions of the country.


13 A steam donkey, or donkey engine, was a steam engine that ran a pulley system that would move (or “yard”) logs from the site of cutting to the logging railroad. At first, the logs were pulled across the ground, but around the turn of the century loggers developed a new technique called “high-lead yarding” where logs were pulled above the ground along wires (“leads”) strung between trees. The steam donkey was invented in California and high-lead yarding was pioneered in Washington. White, *Land Use, Environment, and Social Change*, 86-89, 96-97; Williams, *Americans and Their Forests*, 300-304, 315-320.
Economic conditions likewise altered the pattern of cut-and-run, as the Northwest lumber industry became intertwined with the transcontinental railroads. Federal land grants received by railroad companies for the construction of transcontinental railroad lines facilitated the transfer of western forest lands from the public domain into the hands of private capital. Northern Pacific Railroad became the first transcontinental railroad to connect the Pacific Northwest with the rest of the nation when it completed its line between Duluth, Minnesota and Tacoma, Washington in 1883. In lieu of cash payment for the construction of the railroad, the federal government granted Northern Pacific title to alternating sections of land for up to 120 miles on either side of the railroad. In total, Northern Pacific took title to more than thirty-nine million acres of land, including more than nine million acres in Washington and Oregon—by far the largest federal
land grant to any railroad company. Southern Pacific Railroad, under its subsidiary the Oregon and California Railroad Company, also received substantial land grants in Oregon, totaling nearly three million acres of land. Due to the location of the railroad routes in Washington and Oregon, paralleling the Cascade mountains from the Canadian border to California and crossing over the Cascades from eastern Washington to the Pacific Ocean, much of the land granted to the Northern Pacific Railway and the Oregon and California Railroad Company was prime timberland.

Northern Pacific’s and Southern Pacific’s land grants became the basis for the lumber industry in the Northwest. Rather than selling their federally-granted landholdings to settlers, as required by the railroads’ enabling legislation, the two railroad corporations either sold land to large corporations or retained ownership of their timberlands. In 1900, Northern Pacific sold nine hundred thousand acres of prime timberland to the Weyerhaeuser Timber Company for six dollars per acre, marking Weyerhaeuser’s entrance into the Northwest and setting the stage for the company’s dominance of the region’s timber industry over the next century.

Notwithstanding this massive sale, Northern Pacific retained most of its timberlands in the Northwest.

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16 In a 1930 lawsuit, the Department of Justice even accused Northern Pacific of purposefully designing routes through the Northwest in order to acquire as much valuable timberland as possible. Jensen et al., *Railroads and Clearcuts*, 18.

Northwest throughout the twentieth century. Southern Pacific also sought to retain ownership of its timberland, but ultimately forfeited millions of acres of land back to the federal government in 1916 for failing to sell it.\(^\text{18}\) By 1910, Northern Pacific, Southern Pacific, and Weyerhaeuser owned nearly thirty-five percent of the standing timber in Washington and more than twenty-two percent of the standing timber in Oregon. Indeed, nearly half of the region’s standing timber was owned by only thirty-eight holders, representing significantly more concentration of ownership than in the other timber-producing regions in the country. The consolidation of economic power in the Northwest lumber industry among a few large corporations made it difficult for individuals or small operators to compete in the acquisition of timberland and slowed the transformation of forests into farmland. The economic conditions created in the nineteenth century continued to influence the lumber industry over the next century and into the present.\(^\text{19}\)

By the turn of the twentieth century, many Americans became increasingly alarmed about the depletion of the nation’s forests. Instead of seeing forests places to be eliminated to make way for “progress,” by the late nineteenth century, Americans came to see forests as a resource that was both finite and essential to the nation’s growth. The cutover lands of the Midwest offered a stark example of what could happen if the lumber industry continued its pattern of

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\(^\text{19}\) Department of Commerce and Labor, *The Lumber Industry*, 19-20, 23. The oligopoly created in the Northwest lumber industry at the turn of the 20th century essentially remains to this day. As late as the 1990s, before the incursion of private equity into the landscape, the four largest timber companies in the region all originated with railroad land grant timberland. Indeed, consolidation has continued and gone full-circle as Weyerhaeuser in 2015 acquired Plum Creek Timber, the landholding company spun off from Burlington Northern, the heir to Northern Pacific. Jensen, et al., 25-26, 31; Weyerhaeuser Company, “Weyerhaeuser and Plum Creek to merge, creating the world’s premier timber, land and forest products company,” (November 8, 2015) https://investor.weyerhaeuser.com/2015-11-08-Weyerhaeuser-and-Plum-Creek-to-merge-creating-the-worlds-premier-timber-land-and-forest-products-company.
exploitation. Former lumber boom towns suffered economically while settlers struggled to transform cutover land to farms. Frequent fires swept through the slash and spread to uncut stands of timber, eliminating forests from potential lumber production. The volatile boom and bust character of the lumber industry provided neither steady employment for workers nor steady revenue for lumber companies.\textsuperscript{20} In articles with ominous headlines such as “Timber Waste a National Suicide,” critics of the lumber industry warned that “if the present rate of waste be maintained…a period so near as to be practically tomorrow…is at hand when our existence as a nation will end.”\textsuperscript{21} By the turn of the twentieth century, the social, economic, and environmental consequences of timber extraction led many Americans to call for changes to logging practices and regulation of the nation’s remaining forest lands.\textsuperscript{22}

The establishment of the United States Forest Service (USFS) and the National Park Service (NPS) represent the most significant products of the efforts of conservationists at the turn of the century to regulate and protect American forests. The two agencies embody the philosophical divide in the conservation movement between utilitarianism and preservation.\textsuperscript{23}

\textsuperscript{20} Johnson and Govatski, 42-46, 48; Paul W. Hirt, \textit{A Conspiracy of Optimism: Management of the National Forests since World War Two} (Lincoln: University of Nebraska Press, 1994), 28-29.

\textsuperscript{21} “Timber Waste a National Suicide,” \textit{Scientific American} 34 no. 7 (February 12, 1876): 97.

\textsuperscript{22} Warnings about timber shortages began as early as 1865, but became more urgent by the late nineteenth century. Donald J. Pisani, “Forests and Conservation, 1865-1890,” \textit{The Journal of American History} 72, no. 2 (September 1985): 343-6. See also George Perkins Marsh’s warnings about resource depletion in his seminal work \textit{Man and Nature: Or, Physical Geography as Modified by Human Action} (1864).

\textsuperscript{23} The conservation movement has inspired a rich body of literature, including the classic works Samuel P. Hays, \textit{Conservation and the Gospel of Efficiency; the Progressive Conservation Movement, 1890-1920}, (Cambridge: Harvard University Press, 1959); and Roderick Nash, \textit{Wilderness and the American Mind} (New Haven: Yale University Press, 1967). More recent works have complicated the earlier focus on elites and technocrats to explore the influence of local people in conservation and the effects of conservation policies on the environment, and to expand the temporal and spatial focus beyond the Progressive Era wilderness. For example, see Hal K. Rothman, \textit{Saving the Planet: The American Response to the Environment in the Twentieth Century} (Chicago: Ivan R. Dee, 2000); Sarah T. Phillips, \textit{This Land, This Nation: Conservation, Rural America, and the New Deal} (New York: Cambridge University Press, 2007); Karl Jacoby, \textit{Crimes Against Nature: Squatters, Poachers, Thieves, and the Hidden History of American Conservation} (Berkeley, University of California Press, 2014); Ian R Tyrrell, \textit{Crisis of
Proponents of utilitarian conservation, most famously Gifford Pinchot, called for scientific management of resources by government agencies to produce “the greatest good to the greatest number for the longest time.” The Forest Service, established in 1907 but with its origins in the 1891 Forest Reserve Act, sought to rationalize America’s forests and tame waste in the lumber industry by setting aside timberlands as national forests which would be managed and harvested using scientific forestry methods to meet “present needs without destroying or diminishing the future usefulness of the forest.”

Preservationists, on the other hand, called for protecting American forests and other extraordinary scenic landscapes from development. Beginning with Yellowstone in 1872, Congress set aside areas of exceptional aesthetic and ecological value, and very little commercial value, to preserve as national parks. In 1916, the National Park Service took over administration of these areas, prohibiting resource extraction but allowing for development to support tourism and recreation. Within twenty years of passing the Forest Reserve Act, national

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forests protected more than thirteen million acres of forests in thirteen national forests in Oregon and nine million acres in ten national forests in Washington. One national park in each state, Crater Lake in Oregon and Mount Rainier in Washington, also protected nearly four hundred thousand acres from development. The creation of national forests and national parks in the Northwest and their vast holdings gave the federal government a dominant role in the region’s lumber industry. The regulatory structure established during the Progressive Era defined the ways in which government and private industry interacted with Northwest forest resources for decades to come.

The New Deal

During the interwar years, the Northwest lumber industry experienced extreme boom and bust cycles. The wartime boom in production and profits during the First World War collapsed into intense labor disputes in the late 1910s. During the 1920s, demand for forest products rebounded, but depressed prices for lumber and overproduction plagued the industry. Lumber producers attempted to make up for reduced prices by cutting more and more logs. But this increased production kept prices down and decimated the region’s forests. Unable to sell logged-

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off land due to its unsuitability for farming and largely unwilling to replant trees for future harvest, lumber companies left scarred landscapes across the Northwest as they continued to cut and run.\(^\text{28}\)

The Great Depression exacerbated many of the problems already apparent in the lumber industry. With the collapse of markets, lumber production in Oregon and Washington fell from an all-time peak of more than 12 billion board feet in 1929 to 3.8 billion in 1932. Employment in the lumber industry also fell, with payrolls in Washington dropping from a high of more than $107 million in 1929 to a low of just over $17 million in 1932, and average daily wages falling from $5.25 to $3.30 during that same period.\(^\text{29}\) Unemployment and reduced wages had a significant impact on communities throughout the Northwest, where a large portion of the population depended on the lumber industry, around 32 percent of the population in Oregon and 26 percent in Washington.\(^\text{30}\) As for the depletion of the forests, researchers estimated that Douglas-fir forests covered approximately 14 million acres in Washington and Oregon before cutting began in the nineteenth century. By 1930, only 6.9 million acres remained, mostly in Oregon.\(^\text{31}\) “The waste of productive resources, both natural and human, that seems to be inherent


in our present economic structure is appalling,” James Rettie, a consultant with the Pacific Northwest Regional Planning Commission, wrote in 1939. “We must find some way to bring about greater stability of employment, and to rehabilitate certain large areas that have been depleted of their original resources.”

The crisis of the Great Depression and activism of the federal government under the Roosevelt administration beginning in 1933 led to a turning point for the lumber industry in the Northwest. Government and industry could either turn a blind eye to the environmental and economic devastation inflicted by logging in the Northwest or take action to stabilize the industry and preserve forest resources. In response to the crisis, industry leaders took steps toward self-regulation and considered ways to ensure the longevity of the industry in the region. Federal and state governments intervened to mitigate the damage inflicted upon communities and environments connected to logging and to regulate the industry to prevent waste and exploitation in the future.

The response of the federal government to the crisis in America’s forests took two different approaches. The first, embodied in the National Industrial Recovery Act, promoted industrial self-regulation. The National Recovery Administration’s Code of Fair Competition for the Lumber and Timber Products Industry, signed into law in August 1933, was the first major act of the Roosevelt administration to bring stability to the lumber industry and to promote self-regulation of the industry. The “Lumber Code,” as it became known, set price and production controls, a minimum wage for lumber workers, and a forty-hour maximum work week on the West Coast. Article X of the Code called for a “conservation conference” to create rules to

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promote conservation and sustained-yield forestry practices. The bulk of the Lumber Code was written by industry leaders, but Article X represented a compromise between the Forest Service and lumber industry.33 Before government and industry leaders could devise an effective regulatory framework to administer the Lumber Code, the Supreme Court declared the National Recovery Administration unconstitutional. Industry leaders in the Northwest attempted to encourage self-regulation after the loss of the Lumber Code; however their efforts yielded mixed results. Lumber companies were reluctant to agree to any voluntary restrictions on production for fear of losing out on profits if other companies did not comply and continued to harvest without restriction. Furthermore, all but the largest lumber companies, like Weyerhaeuser, resisted efforts at conservation due to costs, the long-term nature of the investment, and potentially lower profits from limited harvests in the short-term.34

The second approach that the Roosevelt administration took in response to the crisis in the lumber industry and the devastation of the nation’s forests focused on direct government regulation of the lumber industry. Beginning with A National Plan for American Forestry, submitted to President Roosevelt within his first month in office, research and reports created by the Forest Service, the National Resources Planning Board, and other regional planning organizations provided lawmakers with a blueprint for government regulation of America’s forests. These reports laid blame for the deteriorated state of forests on private industry:


34 Weyerhaeuser began efforts at reforestation in the 1930s and established the region’s first tree farm in 1941. Weyerhaeuser Timber Company, Men, Mills, and Timber: Fifty Years of Progress in the Forest Industry (Tacoma, WA: Weyerhaeuser Timber Company, 1950), 9; Robbins, Lumberjacks and Legislators, 195-196.
“practically all of the major problems of American forestry center in, or have grown out of, private ownership.” The Forest Service called for three major solutions: increased public ownership of forest lands, more intensive management of government-owned forests, and government regulation of private forest lands. As Secretary of Agriculture Henry Wallace explained in *A National Plan for American Forestry*, “a satisfactory solution of the forest problem will require the nearest possible approach to national planning. The laissez-faire and avowedly planless policy of private ownership is failing to meet the situation.”

In the Northwest, the National Resources Planning Board and state planning organizations focused much of their attention on local forest resources. In 1936, the Washington State Planning Council called for “a sound program for the conservation and better utilization of our forests, before it is too late.” In the Pacific Northwest Regional Planning Commission’s 1938 report *Forest Resources of the Pacific Northwest* and subsequent reports, planners called for cooperative fire protection, reduction of waste, and adoption of sustained-yield practices, including selective harvesting and reforestation. The Forest Service took these recommendations one step further and argued that if public funds were used to provide fire protection and research on pests and diseases for private forests, then the government ought to

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ensure that those forests were being used wisely. Since self-regulation of the lumber industry proved ineffective, government regulation was necessary. The Forest Service advocated for government regulation of private forest land in the face of extreme opposition from the lumber industry and those who believed the New Deal was “socialist” and continued to do so through the war years.\(^3^9\)

The war arrived at the peak of conservation policy within the federal government. The Forest Service and planning agencies conducted research and produced numerous reports outlining their findings and recommendations. Lawmakers began to implement regulations and programs to mitigate problems that unrestrained exploitation had inflicted on forests throughout the country, and especially in the Northwest, to preserve the nation’s largest remaining timber stands. The war interrupted that process and created a crossroads for leaders in federal agencies responsible for public lands. Should the government maintain conservation policies or abandon them for the sake of the war? How can the government meet the increasing demand for forest products while not relinquishing the progress made in conservation of Northwest forests?

**War Uses for Northwest Forest Products**

The war placed enormous pressure on Northwest forests for lumber to fuel the war machine. Douglas-fir became “the world’s champion fighting tree,” as Northwest trees found themselves transformed into countless products in support of the Allied war effort—from bomb-bay doors to aircraft carrier decks to factory roof trusses.\(^4^0\) As the editors of *American Forests* explained in 1943, “to record the more than two thousand uses to which [wood] was put would


Between 1941 and 1945, loggers felled enough trees in Washington and Oregon to produce nearly fifty-three billion board feet of lumber, comprising one-third of the nation’s entire wartime production. The insatiable demand for forest products to supply the Allied war machine drove increased production in Northwest forests and mills and in lumber regions nationwide. Demand revolved around the strategic needs of the armed forces and changed throughout the course of the war, generally progressing in three overlapping phases. In the first phase, beginning in the late 1930s as war loomed on the horizon, the need for lumber for the expansion of the nation’s industrial and military infrastructure increased demand for Northwest lumber, especially plywood, as a vital building material. The second phase, beginning around 1941, saw lumber utilized as an important substitute for strategic materials like aluminum. In the final phase, beginning around 1942 as the Allies prepared to go on the offensive, Northwest lumber became essential to build boxes and crates to transport war materiel and to construct cantonments overseas. Following trees from Northwest forests to the battlefront reveals their essential role in the war and explains the wartime choices made about preservation and use of Northwest forests.

Phase One

The first phase of demand for Northwest lumber began before the United States entered the war, in response to the anticipated need for mobilization for national defense and to produce materials for the Lend-Lease program. Beginning as early as the late 1930s and lasting

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throughout the war, the first phase utilized lumber as a building material to support the expansion of industrial and military infrastructure within the United States. Advances in forest products research during the 1930s made new materials widely available for the first time during the war. Engineered wood products, especially plywood and laminated structural timber, enabled construction to be completed faster and easier, and replaced steel which could then be used for other essential products like trains, tanks, and ships. Douglas-fir became the most sought-after tree species for these engineered wood products and for general construction during the first phase of wartime uses of Northwest timber. Forests and mills in the Northwest provided the lumber used to expand the nation’s Arsenal of Democracy locally and across the country, serving as a key building material in the construction of military and industrial infrastructure, and housing for the growing industrial workforce.

Northwest forest products contributed to the rapid expansion of the nation’s military and industrial infrastructure. Structural laminated timber and plywood, two key innovations in forest products research in the interwar years, sped the construction of new cantonments and production facilities across the country. Prefabricated laminated wooden trusses with metal ring connectors at joints gave wood the strength to match steel while saving steel and decreasing the time it took to erect structures. Indeed, industry experts estimated that the use of timber trusses in construction saved around four hundred thousand tons of steel in 1942. A number of mills and construction companies in the Northwest became important suppliers not only of Douglas-fir

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lumber for structural applications, but of prefabricated trusses and other structural components. Modern structural plywood was also a relatively recent innovation, first displayed in Portland at the Lewis and Clark Centennial Exposition in 1905. The industry grew in the Northwest in the 1910s, and innovations in adhesive technology in the 1930s enabled manufacturers to produce weatherproof plywood, thus increasing the potential applications for plywood. As one industry expert put it, plywood was “‘good for everything but food and kindling.’” Structural timber and plywood from the Northwest enabled the nation’s military and industrial infrastructure to expand to meet the needs of the war.

Engineers used Northwest forest products to construct production facilities and military infrastructure locally and across the country. Portland firm Timber Structures Incorporated built prefabricated wood trusses for numerous projects including Beech Aircraft Company’s new plant in Wichita, Kansas and a plywood plant in Port Angeles, Washington, both built in 1941. Numerous new shipyards built on the West Coast in the early 1940s also relied on Timber Structures trusses for many of their buildings, including California Shipbuilding Corporation in Los Angeles; Seattle-Tacoma Shipbuilding Corporation in Tacoma; and Oregon Shipbuilding Corporation, Commercial Iron Works, and Willamette Iron and Steel in Portland. The most

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unique contract awarded to Timber Structures was in 1942 for the trusses to support massive dirigible hangars for the Navy. Designed to house non-rigid, lighter-than-air craft used to patrol coastal waters, the hangers were the largest timber structures in the world, measuring 153 feet high, 237 feet wide, and 1,000 feet long. By using wood construction, each hangar saved between two and four thousand tons of steel. A total of seventeen hangers were built along the nation’s coasts, including one in Tillamook, Oregon. Timber Structures built the Douglas-fir trusses for thirteen of the hangars; many of the hangars, including those in Tillamook and Santa Ana, California, used Douglas-fir plywood for their massive doors.\(^\text{49}\) Northwest Douglas-fir lumber and plywood also played an important role in the less extraordinary but nonetheless essential buildings required to support the expansion of the military throughout the United States. Builders used Douglas-fir plywood to construct 286 barracks, 62 recreation buildings, and 53 mess halls at Mitchell Field, New York; Bolling Field, Washington, DC; March Field, California; and other air bases beginning in 1939. As the military’s footprint in the Northwest grew, workers used fifteen million square feet of locally-produced plywood to expand Fort Lewis in Washington in 1941.\(^\text{50}\)


The growth of war industries brought thousands of people into cities across the country and the Northwest. Over the course of the war, more than four million people nationwide moved to work in war industries, and including their families, the total rose to around nine million.\textsuperscript{51} The Seattle and Portland metropolitan areas experienced severe housing crises during the war. Their populations increased eighteen percent and twenty-five percent, respectively, between 1940 and 1944.\textsuperscript{52} In many cities, like Seattle and Portland, the increased population quickly outstripped available housing, prompting the federal government to build housing for war workers. Under the National Housing Administration, the federal government constructed or


guaranteed financing for nearly two million new housing units throughout the United States between 1940 and 1945.\textsuperscript{53}

Northwest lumber and plywood played a crucial role in the expansion of war worker housing in the region. Lumber mills and construction companies used local materials and prefabrication techniques to speed production to accommodate the region’s new residents. The Speedwall Company of Seattle built one hundred and fifty prefabricated duplex units and assembled them on-site at a defense housing project in Bremerton within two months in early 1942. That same year, the Nettleton Company of Seattle constructed nine hundred units for two housing projects near Seattle, completing twelve units per day. In 1944, Northwest Fabricators of Albany, Oregon produced more than one thousand units using local plywood and prefabrication techniques that were shipped to California and erected at defense housing projects in the San Francisco and Los Angeles areas.\textsuperscript{54}

The largest wartime housing project in the United States was Vanport, Oregon, a planned, temporary city built by the Kaiser Company along the Columbia River north of Portland to house workers at the company’s three area shipyards. Construction of the federally-funded community began in September 1942 and opened in less than a year at a cost of $24 million. Vanport provided housing for 40,000 people within 973 apartment buildings, making it the second largest city in Oregon. The community also included 179 utility buildings, three fire stations, a hospital, an administration building, two recreation buildings, a shopping center, five schools, and six


nursery schools. The apartment buildings were partially prefabricated and erected atop a cedar footing. The exterior of the buildings featured Douglas-fir plywood and cedar clapboard siding. Industry experts estimated that the construction of Vanport consumed 50 to 70 million board feet of lumber.\textsuperscript{55}

Phase Two

During the second phase, wood became a substitute for strategic materials in specialized applications, particularly as a substitute for aluminum in aircraft. As war mobilization progressed in the early 1940s, shortages of key materials started to impact production. President Roosevelt’s 1940 national defense program called for the production of 50,000 new aircraft each year, which required massive amounts of aluminum for the modern, all-metal warbirds. Deficiencies in the supply of aluminum began to manifest as early as 1941, and reached a crisis level by 1942. In order to maintain production levels, engineers devised ways to substitute a readily-available material, wood, for the scarce material, aluminum. Only a few tree species could produce aviation-grade lumber with the specific properties required by engineers. Sitka spruce, noble fir, and Douglas-fir proved the best species, with Sitka spruce the most ideal. The use of Sitka spruce and other Northwest firs in aircraft made an important contribution to Allied air power and led to the dispersal of Northwest forest products across the globe. In turn, the boom in demand for aviation-grade Sitka spruce reshaped the extent and locations of extraction of trees from Northwest forests.

\textsuperscript{55} “Vanport City,” \textit{The Timberman} (December 1942): 34-36, 38; “Vanport City, U.S.A.,” \textit{The Bo’s ’n’s’ Whistle} (May 20, 1943): 8-9; “Homes for War Workers,” \textit{The Bo’s ’n’s’ Whistle} (November 26, 1942): 12-13; National Housing Agency, \textit{A Decade of Housing}, 5.
In 1944, editors of The Oregonian mused that “one of the mysteries of this war has been the refusal of military aviation to accept wood construction for combat planes, except when forced by absolute necessity.” The wartime dependence on metal for aircraft did not represent a refusal so much as an inability to quickly make up for two decades of neglect in research. From the end of the First World War through the early 1930s, military and civilian aircraft design had shifted from wood construction to all-metal construction. An ideology of progress and belief in the inevitability of the shift to metal, as had happened in shipbuilding, drove the adoption of metal design for aircraft as much as any considerations of the technical merits of metal over wood. By the 1930s, research and development focused solely on metals, especially aluminum. As aviation historian Eric Schatzberg explains, engineers viewed metal “as a dynamic material, capable of improvement, while wood was seen as static, fixed by nature.” As a result of the dearth of research on wood in aircraft design throughout the interwar years, American airframe manufacturers and the military could not easily pivot to wood construction when confronted with the aluminum shortage in 1941.

Despite the predominance of metal in aircraft construction throughout the war, Northwest forest products nonetheless contributed to Allied air power and served as a substitute for aluminum in a variety of applications in aircraft design. Engineers used wood for significant components of approximately nine percent of the aircraft produced in the United States during the war, totaling about twenty-seven thousand airplanes. Most of these airplanes were trainers.

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56 “The All-Wood Mosquito,” Oregonian (Portland, OR), November 11, 1944.


58 Schatzberg, Wings of Wood, 195-196.
based on prewar designs, such as the Kaydet, built by the Stearman Aircraft Division of Boeing. Kaydet primary trainers, designated PT-13/17 by the Army and NS/N2S by the Navy, featured wood-framed, fabric-covered wings, and a steel-tube, fabric-covered fuselage. Engineers also designed a few wooden cargo planes, like the Curtis-Wright C-76 and Hughes H-4 Hercules, also known as the Spruce Goose, but those designs never saw production. More commonly, engineers devised ways to substitute wood for aluminum in non-structural components of aircraft. For example, Consolidated Aircraft Corporation, maker of the B-24 and PBY Catalina, used spruce for aileron and rudder tabs, and cable guards and covers, among other applications. Boeing used local Douglas-fir plywood extensively in later models of the B-17 for many non-structural components, including doors, seats, tables, containers, racks, and floors. Indeed, the West Coast Lumberman reported that each B-17 contained five thousand square feet of plywood.

The most extensive use of Northwest wood in aircraft design was not in an American plane but in a British fighter-bomber, the DH.98 Mosquito. Designed by the de Havilland company in the late 1930s, engineers devised the all-wood Mosquito to make use of a more


60 Schatzberg, Wings of Wood, 195-212. The Spruce Goose was actually comprised primarily of birch, rather than spruce. For more on the Spruce Goose, please see Graham M. Simons, Howard Hughes and the Spruce Goose: The Story of the Hk-I Hercules (Barnsley, South Yorkshire, UK: Pen and Sword Books, 2014). Or see the Spruce Goose in person at the Evergreen Aviation & Space Museum in McMinnville, Oregon.

61 Letter from J.A. Carpenter, Priorities Department, Consolidated Aircraft Corporation, to the Western Log and Lumber Administrator, November 12, 1942; “Allocations – Spruce, July 1942-January 1943;” Box 4; Western Log and Lumber Administration, Subject Files, 1942-1947; Records of the Office of the Housing Expediter, Record Group 252 (RG 252); National Archives at Seattle (NARA Seattle).

readily available material than aluminum and to take advantage of the skilled woodworkers and furniture factories throughout England. A variety of wood species were used to construct the Mosquito, much of which came from the Northwest United States and Canada. The Mosquito fuselage was a monocoque design, meaning the skin of the fuselage supported the structural load. The skin, constructed of birch plywood sandwiched between balsa, was stabilized with spruce bulkheads. Engineers used spruce and Douglas-fir for the wing spars and stringers to provide strength for the birch or spruce plywood skin. The tail structure also featured wood construction similar to the wings. The control surfaces (ailerons, elevators, and rudder) however, were constructed of aluminum and covered in fabric. Wood proved an excellent material for combat aircraft. Crews reported that damage sustained in combat was less severe and easier to repair than for metal aircraft. The Mosquito played a crucial role for the Royal Air Force as a fighter, bomber, and reconnaissance aircraft. So much Northwest wood went into the Mosquitos and forty other British aircraft that the Office of War Information dubbed Northwest loggers “ground crews for the Royal Air Force.”

The wood used in Mosquitos and other aircraft had very precise material requirements and only a few tree species produced wood capable of meeting the specifications for aero-grade lumber. Industry experts estimated that only around twelve percent of logs harvested “show

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63 “The All-Wood Mosquito,” Oregonian (Portland, OR), November 11, 1944.


indication of making aircraft grade,” and of those, only ten percent were ultimately selected. Indeed, in 1943, industry experts explained that “less than one percent of the lumber cut … (five percent for spruce) has any chance of joining the air corps of the British or American services.” Engineers considered Sitka spruce the best wood for aircraft construction due to its high strength to weight ratio, size of logs, “uniformity of texture, straightness of grain and freedom from defects commonly found in other species of wood.” It also proved easy to dry and mold or glue into shapes. Noble fir was the next best alternative with a similar strength to weight ratio, but generally carried more defects than spruce. Western hemlock and Douglas-fir were also used, but were heavier than spruce and often had more defects.

The growing demand for specific species of wood for aircraft led to increased harvests and shifting sites of extraction. As the need for Sitka spruce and other aircraft-grade species increased, the supply of easily-accessible stands in the Northwest began to diminish. Indeed, a significant amount of Sitka spruce in Washington and Oregon had already been logged during World War I when the demand was high because all aircraft were made of wood, leaving only about ten billion board feet of spruce by 1941. Sitka spruce was also more difficult to obtain because it generally grew in higher elevations, making it more difficult to reach and only

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68 Memo to Aircraft Scheduling Unit from Lewis Sinning, Purchasing Director, Boeing Airplane Company, May 19, 1943; “Aircraft Lumber - Reports - Products - Supplies, 1942-1943 [1 of 2], Box 2; Western Log and Lumber Administration; RG 252, NARA Seattle.
69 W.N. Sparhawk, Report No. 67: Supplies and Production of Aircraft Woods (Washington, DC: US Government Printing Office, 1919), 7-25; Memo to Aircraft Scheduling Unit from Lewis Sinning, Purchasing Director, Boeing Airplane Company, May 19, 1943; Letter to Aircraft Scheduling Unit from Carlile P. Winslow, Director, Forest Products Research Lab, Forest Service, May 22, 1943; Memo to Engineering Division, Wright Field, from J.B. Johnson, Chief, Materials Laboratory, Engineering Division, May 19, 1943; “Aircraft Lumber - Reports - Products - Supplies, 1942-1943 [1 of 2], Box 2; Western Log and Lumber Administration; RG 252, NARA Seattle.
possible during spring and summer.\textsuperscript{70} By 1942, the spruce situation reached a crisis point. In July 13, 1942 the War Production Board issued order M-186 which placed Sitka spruce under the control of the WPB so it could be inventoried and allocated where it was needed most. The War Production Board sought to decrease demand by encouraging the use of alternative species when possible, and increase supply by locating additional sources of Sitka spruce. Officials identified two potential new sources in the United States: Olympic National Park in Washington and Tongass National Forest in Alaska. The Forest Service estimated that Olympic National Park contained as much as 750 million board feet of Sitka spruce, including around 50-75 million of aero grade spruce.\textsuperscript{71} However, convincing the Park Service to allow logging in the park proved difficult, so the War Production Board turned to Alaska instead.\textsuperscript{72}

The War Production Board established the Alaska Spruce Log Program in May 1942 to provide Sitka spruce to meet the increased demands for aviation-grade lumber. The concept for the Alaska Spruce Log Program (ASLP) originated with Alaska’s regional forester, Frank Heintzeleman. In late 1941, Heintzeleman brought the spruce resources of Tongass National Forest to the attention of forestry and war planners in Washington, DC. Together with lumber industry


\textsuperscript{71} “Aircraft Lumber: Character of Aircraft Lumber Industry” draft report, October 1945, 13; “Production Reports - Actual and Est., Jan 1944-July 1945;” Box 89, Western Log and Lumber Administration; RG 252, NARA Seattle.

\textsuperscript{72} More on the fight over logging spruce in Olympic National Park later in this chapter.
leaders in the Northwest, they devised a plan for extracting spruce from Tongass, which the War Production Board authorized in 1942.73

Managed by the Forest Service, the ASLP hired contract loggers, most from the Northwest, to cut Sitka spruce in the Tongass National Forest. Nine logging camps were established within the forest and the Forest Service provided loggers with modern equipment, including power saws, diesel- and steam-powered donkey engines, diesel tractors, and trucks. Logs were transported by truck or water to Edna Bay in Southeast Alaska where logs were collected into large Davis rafts meant for ocean transportation and then towed by tugboat nearly one thousand miles to Puget Sound. The first raft of logs arrived in Anacortes, Washington in late January 1943 and contained just under one million board feet of lumber, most of which was spruce, but also a small amount of hemlock for experimental purposes. ASLP logs were brought to mills in Anacortes, Bellingham, Everett, and Aberdeen because mills in Puget Sound had greater capacity and more experience with aviation-grade lumber than those in Alaska.74 By early 1944, production of aluminum had increased and the Canadian government began to allow the import of spruce from British Columbia. The frantic demand for spruce had eased, so the War Production Board shut down the ASLP. Loggers ceased cutting in March 1944 and the last raft of logs arrived in Puget Sound that fall. Over the course of its existence, the ASLP provided

73 “Aircraft Lumber: Character of Aircraft Lumber Industry” draft report, October 1945, 14; “Production Reports - Actual and Est., Jan 1944-July 1945;” Box 89; Western Log and Lumber Administration; RG 252, NARA Seattle; “Alaska’s Forests Yield Airplane Spruce,” West Coast Lumberman (July 1943): 12; Rakestraw, 120.

more than eighty million board feet of lumber, including around thirty-eight million board feet of high-grade Sitka spruce which produced about 7.5 million board feet of aviation-grade lumber.\footnote{Rakestraw, 124; “Alaska Log Program To Be Suspended,” \textit{The Timberman} (March 1943): 38; “Aircraft Lumber: Character of Aircraft Lumber Industry” draft report, October 1945, 15; “Production Reports - Actual and Est., Jan 1944-July 1945;” Box 89, Western Log and Lumber Administration; RG 252, NARA Seattle.}

Phase Three

Lumber from the Pacific Northwest became part of the vast network of material that flowed from the United States across the world to support the allied war effort in the third phase of war uses for Northwest lumber. The shifting military strategy over the course of the war effected the demand for raw materials and war materiel. By 1942, the United States began deploying Army Air Force personnel to England, and in November 1942, the Allies invaded North Africa. The Allies continued to mainland Europe beginning with the invasion of Sicily in July 1943 and the culminating in the cross-channel invasion of Normandy in June 1944. In the Pacific, the Battle of Midway in June 1942 proved a decisive defeat of the Japanese Navy, forcing them into a defensive strategy. Shortly after the Battle of Midway, US Marines invaded Guadalcanal, representing the beginning of the Allied “island-hopping” campaign across the Pacific.\footnote{This exceedingly simplified summary of the overarching American and Allied strategy and major turning points is intended only to illustrate the broad themes and major turning points of the war from the American perspective in order to lay a foundation for discussing the role of Northwest lumber in the execution of the war. For more details, an extraordinarily vast body of literature exists on the military history of World War II. Please see footnote thirteen of the introduction for works produced by the armed forces’ historical divisions} This expansion of American military presence overseas required an enormous amount of materiel, most of which originated in the United States. The movement of American personnel and supplies overseas involved ships and airplanes for transport, boxes and crates for packing, and building materials to construct combat infrastructure and overseas military installations. Lumber served an integral role in the logistical network that supplied the Allied war effort, a
primary factor in the Allies’ victory, and Northwest forests provided a significant portion of that lumber.77

As the Allies moved onto the offensive and American troops deployed into active combat, the military developed an extensive logistical network to house and supply its soldiers, sailors, and marines. Industry experts estimated that it took three hundred board feet of lumber to send a soldier overseas and an additional fifty board feet per month to supply each soldier. Put another way, it took three trees “to equip and maintain each man in the army, two for every man in the other services.”78 In order to move the massive amount of materiel required for war, the military needed boxes, crates, and other packing materials. In 1941, around 5.5 billion board feet of lumber went into the construction of boxes and crates, increasing to nearly 9 billion board feet in 1942, representing around twenty percent of the total lumber production that year.79 As the Allied strategy shifted over the next year, the War Production Board reported that “an almost insatiable appetite developed for any kind of wood that could be used to package and protect shipments of cargoes in transit.”80 By 1943, the construction of boxes and crates consumed 15 billion board feet, around forty-five percent of the nation’s total lumber production.81 In 1944,


80 War Production Board, Wartime Production Achievements and the Reconversion Outlook (Washington, DC: War Production Board, October 9, 1945), 75.

the War Production Board estimated that boxing and crating needs for the coming year would consume more than half the nation’s lumber output, around 17 billion feet. Northwest box manufacturers contributed to these needs, constructing a wide variety of boxes, crates, and other containers with plywood and box shook made of Douglas-fir, pine, and western hemlock. Manufacturers throughout the Northwest built footlockers, waterproof chests for communications equipment, medical supply chests, ammunition and ordnance boxes, cases for rifles and other weapons, and waterproof chests for emergency rations.

Northwest forest products made their way into combat in Europe and the Pacific in a variety of formats. Lumber played an important role in the Allied invasion of Normandy on June 6, 1944 and the subsequent ground offensive in Europe. The Navy estimated that the Allies used ten million board feet of lumber just for the beachhead of the Normandy invasion. As the Allies advanced through Europe, the Army required around one million feet of lumber from American mills per day. Northwest lumber went into the construction of barges for the Army Transportation Corps to supply the front. The Army Corps of Engineers used Douglas-fir plywood to build pontoon bridges to replace those destroyed in combat. Boat builders around the country used Oregon-made Douglas-fir plywood to construct assault boats used in various operations in Europe, including the Rhine River crossings in the spring of 1945.

82 “Billions for Boxes,” The Timberman (April 1944): 90.
84 “Lumber in the War Theaters,” West Coast Lumberman (February 1945): 45.
Lumber also supported the Allied island-hopping campaign in the Pacific. Shipbuilders in the Northwest made extensive use of Douglas-fir in the construction of wooden floating drydocks for the Navy. These floating drydocks were towed to various locations throughout the Pacific Theater to speed repairs of vessels on-site, rather than towing damaged vessels back to shipyards in Hawai‘i or the West Coast.\textsuperscript{86} Northwest manufacturers also constructed prefabricated buildings from local lumber and plywood for a variety of purposes overseas. For example, Pacific Huts of Seattle designed and built prefabricated all-wood huts that could be shipped in sections for easy transport and assembly overseas. The Burke Millwork Company in Seattle built 750 hospital barracks in the fall of 1944 for deployment overseas, using 3.5 million board feet of lumber and 2.8 million square feet of Douglas-fir plywood. Several mills in the Northwest built prefabricated wooden barracks for the Army Corps of Engineers that would serve as hospital buildings in the Southwest Pacific and as barracks in Alaska\textsuperscript{87}. Northwest forest products were essential to the logistical network that supplied American and Allied forces and kept them moving across the globe. An officer “at some remote but unnamed base” explained the importance of lumber to the military overseas: “‘if you could see us use every available piece over and over, until nothing is left but slivers, you’d know just how important it is.’”\textsuperscript{88}

\textbf{Limitations}

Trees from the Pacific Northwest found themselves transformed into myriad products and distributed across the globe in support of the Allied war effort. However, despite the great

\textsuperscript{86}“All Wood Floating Drydocks,” \textit{The Timberman} (February 1944): 28-29.


demand for Northwest timber to create these countless products, the war did not lead to the liquidation of the region’s forests. Instead, wartime harvests remained fairly steady and never exceeded prewar rates. Oregon and Washington produced 10.6 billion board feet of lumber per year on average between 1941 and 1945, with production peaking at around 11.5 billion board feet in 1941 and 1942. In contrast, during the lumber boom of the 1920s, Oregon and Washington together produced on average 11.4 billion board feet per year, peaking in 1929 with 12 billion board feet harvested.  

Although former Chief of the Forest Service William Greely described the war as “a lumberman’s carnival,” several crucial factors emerged that explain the relative restraint of lumber producers. Labor shortages, technological obstacles, and the federal government’s commitment to conservation policies served to temper the rate of harvest and prevent the wartime demand from precipitating widespread destruction of the region’s forests.

Labor

The shortage of workers in the lumber industry represented the single most significant factor limiting the production of lumber during the war. In 1940, more than 43,000 people in Oregon and 56,000 people in Washington worked in logging and sawmills. But once the United


States entered the war, workers began to leave the forests and mills for the military and employment in other war industries. By late 1942, the War Production Board estimated that the Northwest had lost 15,000 people from employment in the lumber industry. The Western Operators Association estimated in September 1942 that logging camps in Western Washington were “short 5,000 loggers” compared to employment levels in 1941 and the personnel needed to keep up with increased demand. A year later, writers at Fortune estimated that there were nineteen percent fewer workers in the lumber industry on the West coast than there had been in 1940. Arthur Upson, Chief of the Lumber and Lumber Products branch of the WPB declared in 1942 that “the No. 1 reason for a drop in lumber production is the loss of labor.” He estimated that logging crews were down around thirty percent compared to prewar numbers, leading to a forty percent loss of efficiency in lumber production.

The attrition of manpower in the woods and mills was primarily due to men being drafted or joining the military, or seeking employment in other war industries. Many lumbermen left the woods to work in the shipyards in Portland and Puget Sound. Jobs in the shipyards or other war industries offered higher wages, steadier and easier work, and a seemingly more direct contribution to the war effort. As The Timberman commented in August 1942, “as things now stand, our camps and mills seem to be regarded by a good many employes [sic] as the springboards from which to jump to the shipyard or the aircraft factory.” A 1942 study by the

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Bureau of Labor and Statistics on workers hired by West Coast shipyards in June of that year revealed that the lumber industry represented the largest single previous employer for new recruits to the Portland-Vancouver shipyards, with 8.5 percent of the 1,860 new workers having come directly from jobs in the lumber industry.\textsuperscript{96} Losing men to the draft also proved problematic in the early war years. Initially, the Selective Service system allowed for draft deferment for farm workers, but not those in many other industries, including lumber. To compensate for farm deferments, local draft boards drew people working in other industries. In many rural parts of the Northwest, agriculture and logging took place within the same counties, so a disproportionate number of loggers were drafted from some areas.\textsuperscript{97}

Inadequate and unstable employment numbers in the woods and in the sawmills created bottlenecks and slowed production of the forest products needed for the war. Insufficient manpower in the woods proved particularly problematic. Without enough workers to fall, buck, yard, and transport timber to the mills, the mills would not have lumber to process and would occasionally shut down. Once shuttered, even temporarily, the mill workers either went to other mills or left the industry for other war work. A mill operator in Southern Oregon explained the problem in 1943: "'Last summer the army took the loggers, truck driver and hooktender. After that the mill was shut down quite a bit of the time waiting for logs.'" Another mill operator from Oregon stated that, "'we have the available timber, equipment and everything excepting manpower, but the real bottleneck is fallers and buckers.'"\textsuperscript{98} In June 1943, the Western Log and


\textsuperscript{97} War Production Board, \textit{War Production in 1944} (1945), 48.

\textsuperscript{98} “Manpower Needs of Western Lumber Industry Vividly Portrayed,” \textit{West Coast Lumberman} (March 1943): 10, 11.
Lumber Administration reported on the production of lumber for aircraft and noted that the manpower situation was impacting production. “In the Grays Harbor area, one gypo logger producing good quality spruce has finally quit and sold his equipment because of the manpower shortage. He was simply not able to secure fallers and buckers.”

Indeed, as demand increased by mid-war, production decreased. In 1942, Oregon and Washington together produced 11.5 billion board feet of lumber, while in 1943 production dropped to 10.9 billion board feet and to 10.7 billion board feet by 1944.

The federal government and lumber industry undertook a number of strategies to remedy the labor problem. In September 1942, the War Manpower Commission issued an order which classified the forest products industry as an “essential industry” in twelve western states. In addition, the Selective Service classified sixty-seven occupations within the lumber industry as “critical occupations.” These reclassifications enabled timber workers to request draft deferments and remain on the job in lumber production. By Spring 1943, the War Manpower Commission also began actively urging workers with logging experience working in other industries to return to the woods. In its “Back to the Woods” campaign, the WMC argued that “The forests are the battlefront for all loggers.” The change in classification for the lumber industry as an “essential industry” with “critical occupations” helped stem the flow of workers.

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99 Memo to J. Philip Boyd from F.H. Brundage, June 1, 1943; “Aircraft Lumber - Reports - Products - Supplies, 1942-1943 [1 of 2];” Box 2; Western Log and Lumber Administration; RG 252, NARA Seattle.


103 “Woodworkers Return is Sought By WMC,” *Timber Worker*, (21 April 1943).
from the woods to the military, but the “Back to the Woods” campaign did not repatriate a significant number of loggers.

By 1944, the labor situation in the woods was so desperate that the War Department issued guidelines to the lumber industry about how to utilize prisoner of war labor. POWs could not perform dangerous jobs or work in hazardous conditions, per the Geneva Convention. The War Department outlined which jobs POWs could not perform, including handling explosives, operating power machinery, and “felling or bucking on exceedingly steep slopes.”

The War Manpower Commission organized the use of POW labor and worked with the Regional Labor-Management Committees to certify the use of POWs in local industries. But the committee members in the Northwest refused to certify the use of POWs in the lumber industry. The powerful unions representing timber workers in the Northwest also opposed POW labor.

Western Log and Lumber administrator F.H. Brundage advised the War Production Board that he did not want to employ POWs. In a February 1944 letter to the WPB, he explained “that I do not consider the use of war prisoners in the woods and mills either practical or desirable… I suggest that any effort to secure the use of war prisoners be discouraged.” Ultimately the WMC acquiesced to the pressure and did not assign POW labor the lumber industry in the Northwest.

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106 Letter from Brundage to WPB 5 February 1944; “Labor - Use of War Prisoners;” Box 143; Western Log and Lumber Administration; RG 252, NARA Seattle.

107 Although POW labor was not used in the Northwest, nationwide the lumber industry utilized the labor of 9,000 POWs. Gerald W. Williams, *The U.S. Forest Service in the Pacific Northwest: A History* (Corvallis: Oregon State University Press, 2009), 128.
Hiring women proved one of the most successful solutions to the labor problem. Women had been working in some sawmills in small numbers before the war, but employment of women became more widespread as the labor shortage worsened in 1942. The culture of the lumber industry was largely unwelcoming to women, but the desperation for workers enabled women to secure a place for themselves in the industry. Women comprised as much as one-third of the labor force in sawmills during the 1940s. In the mills, women performed all manner of jobs including feeding wood into planing machines, operating lift trucks, sorting parts in the salvage department, racking and stacking lumber, and grading and scaling lumber. In the woods, women worked as “flunkies” (cook assistants), housekeepers, and even as whistlepunks, who operated a steam whistle to communicate between the workers hitching felled logs to the yarding cables and the worker operating the yarding machine. Reporting in American Forests, acclaimed journalist Mary Hornaday declared that “there is no question whether women should or should not be working in lumber mills and with logging crews. Somebody has to get the lumber out for barracks, gliders and ships and there aren’t enough men to win the war and the battle of production too.” The West Coast Lumberman estimated that by fall 1943, more than


112 Hornaday, 527.
6,000 women worked in the West Coast lumber industry. “Great credit is due this great army of women which has literally ‘saved the day’ for the lumber industry.”

Technology

Another way that the logging industry attempted to compensate for the loss of labor was to improve efficiency through the use of technology. Innovations in machinery and equipment in the 1930s began to replace animal and steam power with diesel power in the woods. Diesel-powered yarding machines replaced steam donkeys, gas and diesel-powered caterpillar tractors and trucks replaced logging railroads, and power saws replaced crosscut saws and axes. Northwest lumberman had just begun to adopt these new technologies when the war started. But the shift to production of military equipment made it more difficult to keep trucks and tractors running and hindered the widespread adoption of chainsaws until after the war, thus limiting the increased production that mechanization could have generated.

Tractors first appeared in western logging camps as early as the 1890s. Loggers used these early steam-powered tractors to haul logs, often replacing horses or oxen in that task. The use of tractors became more widespread after World War I as technology improved and veterans who had used tractors during the war understood their utility for logging. Innovations during the 1920s and 1930s, especially the introduction of diesel engines and caterpillar treads, made tractors more powerful and more maneuverable. New devices, such as the steel pan and logging

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arch, enabled loggers to use tractors to skid and yard logs faster, easier, and with less damage to the forest floor and young trees than with older methods. Tractors also brought power to the forest by acting as portable generators. Tractor generators replaced steam donkeys to power the winches driving yarding cables. They also provided electricity for the new power saws used in felling and bucking. Finally, tractors graded new logging roads further into the forest, replacing skid roads, plank roads, and railroads, and facilitating the use of modern logging trucks.\textsuperscript{116}

The use of trucks in logging in the Northwest dates to around 1914, when two operators in western Oregon and central Washington began to use motor trucks to haul logs from the woods to the mill.\textsuperscript{117} During the 1910s, loggers modified trucks and wagons to transport logs within forests and from forests to mills, and a few companies began building trucks rugged enough to use in the woods.\textsuperscript{118} In 1915, the Gerlinger Motor Car Company of Seattle debuted a structural steel-framed six-cylinder motor truck, dubbed the Gersix, which became popular with loggers. By 1923, the company had reincorporated as Kenworth Motor Truck Company and in 1928 produced the first purpose-built logging truck.\textsuperscript{119} Throughout the late 1920s and 1930s, innovations in gasoline- and diesel-powered engines, tire materials and tread pattern, and truck and trailer design helped truck logging to gain traction within the lumber industry. By 1936,


\textsuperscript{117} “Motor Truck Logging Costs: Case Examples from the Field,” \textit{The Timberman} (March 1940): 16.

\textsuperscript{118} “Motor Truck Logging Costs: Case Examples from the Field,” \textit{The Timberman} (March 1940): 16; “Beginning of Western Truck Logging,” \textit{The Timberman} (October 1949): 168, 170.

industry experts estimated that loggers in Washington and Oregon employed around 1,000 to 1,200 trucks; that number grew to around 18,000 nationwide by 1942.\textsuperscript{120}

Tractors, logging trucks, and trailers enabled loggers to penetrate deeper into the forest to access more remote stands and remove logs without clearing the entire forest. They also proved a faster and more cost-effective method of transporting logs from the forest to the mill.\textsuperscript{121} As The Timberman explained in 1941, “log and lumber trucks have emancipated” loggers from railroads and waterways. Trucks could go where railroads could not, further into the steeper terrain of mountains. “Like beetles they climb dizzy, zig-zagging roads to the towering tops and come down again heavily loaded.”\textsuperscript{122} The agility of these machines also enabled loggers to engage in more sustainable practices, such as scavenging burns and selective logging.\textsuperscript{123} By the time the United States entered the war, tractors had become “the backbone of present day logging methods,” and most operators in the Northwest relied on motor trucks for transportation.\textsuperscript{124}

While the lumber industry had fully integrated tractors and trucks into operations by the time the war started, power saws were not yet as commonplace, but held great promise for increased efficiency. In the mid-nineteenth century, inventors began to tinker with and patent

\textsuperscript{121} Girard, “Logging the New Way,” 199.
\textsuperscript{122} “Trucks Change Logging Picture,” The Timberman May 1941, 58.
various ideas for an endless saw made of a looped chain of cutting teeth. None of these early designs made it into production, however. By the early twentieth century, advances in mill-based power saws, steam- and gasoline-powered engines, and saw design made practical power chain saws feasible. Machine shops on the west coast of the United States and Canada and in Germany began producing power chain saws in the late 1920s and early 1930s. Although these saws saved labor for fallers who would otherwise use axes and crosscut saws, the chain saws were largely impractical for use in the woods. The Dow Low Stump Power Saw, introduced in 1933, could “‘cut like hell,’” if logging companies could afford its $990 price tag and successfully maneuver it through the woods. The 460-pound saw was powered by an Indian motorcycle engine and “mounted on wheels adapted from a World War I fighter plane.”

Slightly less unwieldy, other early power saws used electric power produced by generators mounted on caterpillar tractors. Some of the most successful early power saws were developed by Andreas Stihl in Germany in the late 1920s. The saws had small internal combustion engines and were of a weight and size that was manageable for one or two workers, making them more portable and easier to deploy in the woods. Throughout the 1930s, fallers and buckers remained suspicious of power saws, fearing they might take away jobs, and the trade journals debated their practicality. Only a few logging operations in the Northwest adopted power saws before the war.

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126 Lee, Chainsaws, 54-57.

127 For example, the Dow chainsaw from the early 1930s was powered by an Indian motorcycle engine and was mounted on wheels modified from World War I-era aircraft landing gear. It weighed 460 pounds and cost nearly $990 in 1933. Lee, Chainsaws, 34-36, 46-47, 55-58; Lucia, “A Lesson From Nature,” 162-163.

By the time the war started, chain saw design had improved enough that logging companies began adopting them on a more widespread basis. The war aided the development of power saw technology and at the same time slowed its dissemination. During the 1930s, Stihl had sent prototypes of its saws to logging companies and saw makers in North America to demonstrate their effectiveness. Once Germany was at war with Great Britain and the United States, Stihl lost its international patent protections and machine shops throughout the US and Canada made copies of the Stihl saws and borrowed the technology for their own designs. The wartime labor shortage helped convince more loggers to use power saws. As one logging company leader asserted in 1944, “the manpower shortage has set chain saw progress ten years

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129 Lee, Chainsaws, 61; Lucia, “A Lesson from Nature,” 163.
in advance of where it would have been otherwise.”” The labor-saving benefits of chain saws propelled them to popularity during the war. Engineer George Ropkins explained that in 1940 “the camp with a power saw was the exception, but today [1944], the camp without power saws of some make or type is unusual.”¹³⁰ Chain saws became “as vital to the war effort as a Garond [sic] Rifle.”¹³¹

Chainsaws, tractors, and trucks saved labor and sped production, but only if logging companies could acquire them and keep them running. One of the major problems faced by the lumber industry during the war was lack of access to new equipment and the parts and materials to repair existing equipment. Industry leaders anticipated this issue early in the war. In an editorial in November 1941, the editors of The Timberman asserted that “it is only reasonable to ask that if lumber is to be called upon to fill the gap caused by the shortage of steel and other critical materials, the lumber industry should have the tools with which to produce it… The steel needs of the lumber industry must be supplied because more steel for wood means more wood for steel!”¹³² Not only did the military and war industries need the materials used to manufacture logging equipment and tools, but they needed the equipment and tools as well. Indeed, the War Production Board estimated in late 1942 that “probably 10 percent of the cause of the reduction in lumber production is lack of equipment and repair parts… The armed forces take 85 percent of the tractor production each month leaving only 15 percent for civilian and industrial use.”¹³³ In

March 1943, a “government official” told the *West Coast Lumberman* that “we are hopeful that sufficient factory capacity can be found or created which will give our loggers the required number of saws without encroaching on the requirements of the army and other armed forces.”

Despite the best efforts of the War Production Board and other agencies, the Northwest lumber industry lacked sufficient equipment throughout the war. Trade journals from the war years teemed with the frustrations of loggers attempting to meet production demands with labor and equipment shortages. In the April 1943 issue of the *West Coast Lumberman*, C.C. Jacoby, a logging superintendent from Toledo, Oregon, lamented that “every day a log truck is idle due to lack of repair parts is a day lost never to be regained and means less logs are to reach the mill.” A.F. Rhyne, a logger from Raymond, Washington, said that “tires and parts for trucks,” are the biggest problems facing truck loggers. Earlier that year, the editors of the *West Coast Lumberman* explained that “a big backlog of unfilled orders for more power saws indicates success for this modern piece of woods equipment and leads to the safe conclusion that more logs would be coming out of the woods if they were available.” Although it is impossible to calculate exact figures, loggers certainly could have extracted much more timber from the forests if wartime conditions had allowed for the new technologies of trucks, tractors, and chainsaws to be utilized to their full potential.

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136 Ibid. 11.

Conservation Policy

Federal agencies that oversaw public forest lands in the Northwest played a role in limiting timber extraction by maintaining the conservation policies established during the New Deal era. Before the US entered the war, leaders in the Department of the Interior and Forest Service anticipated that the resources held within public lands could be called upon to support the war effort. In 1940, Secretary Ickes argued that “now, more than ever before, we must prevent attempts being made to raid our resources recklessly…We must not be misled by attempts to improperly exploit our oil, our fish, our timber, our grazing lands under the guise of necessity… All of us must be sentinels over our rightful heritage.”138 The Department of the Interior, and its subordinate agency, the National Park Service, along with the Forest Service largely maintained their agency’s missions in the face of extreme pressure by the lumber industry for the exploitation of public lands to meet the demands of war production, preventing lumber companies from engaging in unsustainable harvesting practices on public lands.

As the agency embodying the preservation branch of conservation, the National Park Service sought to protect the forests under its jurisdiction in the Northwest from logging. From the beginning of the war the agency recognized that its mission would come into conflict with wartime demand for resources. However, Secretary Ickes and Park Service Director Newton Drury argued that the preservation of parks provided the greatest benefit to the war effort. As Drury argued in his 1945 annual report, “the National Park Service looks upon itself as the guardian of perhaps the greatest living testamentary trust ever established. The concept of conservation of a small portion of our land, not for consumption of its natural resources, but for

its preservation to minister to the human mind and spirit, because of surpassing grandeur or other special and profound significance, is one almost unique to the United States of America.”\textsuperscript{139} To protect the integrity of the parks, the NPS devised a policy to allow for extraction of park resources if the use was “based upon critical necessity,” and “all reasonable alternatives have been exhausted before invading the national park areas.”\textsuperscript{140}

A major test of this policy came during the aircraft spruce crisis in 1942. As soon as the war started, lumber companies began pressuring the National Park Service to open parts of Olympic National Park to logging. During World War I, the Army’s Spruce Production Division cut aviation-grade Sitka spruce from areas of the Olympic Peninsula for aircraft production, and loggers hoped to take advantage of the renewed demand and harvest spruce that had become part of the park in the intervening years.\textsuperscript{141} Created in 1937, the park included the former Mount Olympus National Monument and parts of Olympic National Forest surrounding the monument. Over the next few years, the federal government acquired several areas adjacent to the park for expansion, but as of the beginning of the war, had not yet formally added them to the park.\textsuperscript{142}


Many locals, because they made their living through logging, opposed the creation of the park and its subsequent expansion, especially when war became eminent. Local business organizations and lumber industry groups called for opening the park to logging Sitka spruce. In editorials and journal articles, these groups argued that “the locking up of spruce… ‘retards the air defense program,’” and that leaving the “mature and over-mature” timber in place was a waste.\(^{143}\) The Seattle Chamber of Commerce even argued that there was enough “typical Western Washington forests already preserved in Rainier National Park and other public reservations,” so the preservation of timber within the Olympic expansion areas was unnecessary.\(^{144}\)

Director Drury, Secretary Ickes, and other conservation groups maintained that the demand for Sitka spruce did not meet the requirements of NPS policy for extraction of timber within park lands. In his 1943 Annual Report, Drury argued that all other supplies of Sitka spruce in Washington and Oregon should be tapped and alternative materials utilized before “the forests in Olympic National Park are destroyed and an outstanding natural spectacle lost to America forever.”\(^{145}\) However, demand for aircraft spruce grew so intense that Ickes acquiesced and in late 1942 authorized limited logging within the Queets corridor, one of the areas not yet annexed to the park. Historians argue that local park administrators and the War Production Board, both heavily influenced by the lumber industry, were responsible for pressuring Drury and Ickes into changing course to allow for logging. Loggers ultimately cut around three- to

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four-million board feet of Sitka spruce from the Queets corridor in 1943, but Ickes denied further requests from the War Production Board for logging in the park.146 “I am reliably informed that no aircraft factories manufacturing wooden planes for the armed forces of the United States and of Great Britain have been compelled to shut down because of lack of suitable materials,” Ickes wrote to Washington Representative Fred Norman in August 1943. He went on:

The national parks are a vital part of the American heritage that makes this Country worth fighting for. The undisturbed natural condition of those areas is what makes them sources of inspiration and pride in our Nation, as well as the finest outdoor laboratories of natural history. We hope that when this war is over the United States will have retained those things which are sources of inspiration and patriotism. The cut-over lands adjacent to Olympic National Park do not instill such emotions, and the reduction of the park to a similar condition would be resented by our soldiers and sailors when they return.147

Ickes continued to reject proposals to extract lumber from the park after the initial logging of the Queets Corridor. By the Fall of 1943, lumber from the Alaska Spruce Log Program and British Columbia had added millions of board feet to the supply in the Northwest, aluminum production capacity had grown, and the Army Air Force had modified their requirements for lumber, easing the demand for Olympic National Park spruce. The changing needs of the war, increased production from other sources, and Ickes’ personal intervention on behalf of the park preserved the vast majority of Olympic National Park’s unique rainforests.148

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147 Letter from Ickes to Representative Norman, 24 August 1943; “Timber, Government, Olympic Nat'l Park, 1943;” Box 115; Western Log and Lumber Administration; RG 252, NARA Seattle.

Unlike the National Park Service, the mission of the Forest Service did not call for the preservation of forests for their intrinsic value. Nonetheless, the Forest Service remained dedicated to conservation policies throughout the war, despite the increased demand for lumber. Chief Forester Earle Clapp warned in 1942 that “we do not want to find, after the war is over, that we… have unnecessarily impaired or destroyed one of the basic resources of the land we have been fighting to protect.”¹⁴⁹ In Forest Service reports during the war, the agency laments that current production could be better if private forests had not been mismanaged in the past. For example, the 1942 report highlights the past exploitation of forest resources as a reason for decreased lumber production in 1942. “Our tolerance of destructive liquidation over the years means that we no longer have abundant saw-timber supplies accessible throughout the country. We now have to search out isolated remnants of timber for specialty uses.”¹⁵⁰ Rather than using the wartime lumber shortages and demand to condone unrestrained exploitation of the nation’s forest resources, the Forest Service continued throughout the war to call for comprehensive management of the nation’s forests, both public and private, on a sustained-yield basis.¹⁵¹

Harvesting from National Forests during wartime continued the patterns set during the New Deal, where the vast majority of logging occurred on private stands and National Forest timber served as a backup for when private stands became depleted. Although harvests increased, they remained a small percentage of overall lumber production, peaking in 1944 at ten


percent of all lumber cut in the United States.\textsuperscript{152} Despite the rising demand for timber, the Forest Service continued to harvest on a sustained-yield basis, cutting beyond sustainable limits only in a few instances to prevent mills from shutting down. Forest management was kept to a minimum, with slash disposal and reforestation activities reduced due to manpower limitations.\textsuperscript{153}

A limited triumph for conservation came in the form of the Sustained-Yield Act of 1944. Signed into law in March of 1944, the Sustained-Yield Act represented a small step toward mandating sustainable forestry practices on both public and private lands. The Act authorized the creation of public-private cooperative units of forest land to be managed on a sustained-yield basis, limiting harvests to allow for regeneration of the forest in order to provide a continuous supply of logs to maintain the longevity of the lumber industry in that area.\textsuperscript{154} The first application for a cooperative unit came from the Simpson Logging Company in Sheldon, Washington, two days after the bill was passed. The Sheldon Unit began operation in 1946 and was the only cooperative unit established from the 1944 Sustained-Yield Act.\textsuperscript{155} Although the Sustained-Yield Act was largely the work of timber company consultants and the Forest Service


had little input, its passage during wartime demonstrated the continuity of commitment to conservation from the New Deal through the war years.\textsuperscript{156}

**Conclusion**

The war created an insatiable demand for forest products. Northwest trees found themselves transformed into an incalculable number of products and shipped to all corners of the globe to support the Allied war effort. As one advertisement asked, “how did that tree get over Berlin? Just a few months ago it was towering in the forest. Now it’s a bomb-bay door. Last night it sped over enemy territory at 400 miles per hour.”\textsuperscript{157} As the United States mobilized for war, Northwest lumber played an important role in expanding the nation’s industrial and military infrastructure. Innovations from the Interwar years, especially structural laminated timber and plywood, enabled engineers to use wood in place of steel to speed construction of new production facilities. Over the course of the war, the United States used 48 billion board feet of lumber for construction of factories, shipyards, and cantonments. Engineers also used wood from Northwest forests, particularly Sitka spruce, as a substitute for aluminum in aircraft manufacture as supplies of aluminum ran short beginning in 1941. 100 million board feet of aircraft-grade lumber was used during the war, including Sitka spruce, Douglas-fir, and noble fir from the Northwest. Alaska provided an additional 40 million board feet of Sitka spruce. Finally, Northwest wood supported the Allied forces as they went on the offensive. 10 billion board feet


of lumber went into the production of weapons and military equipment. Boxes, crates, and dunnage for transporting all the materiel across the globe used up 43 billion board feet of lumber.\textsuperscript{158} Overall, Oregon and Washington supplied nearly 53 billion board feet of lumber during the war, one-third of the nation’s total production.\textsuperscript{159}

![Timber Harvests, 1880-1950 (mbf)](image)

Figure 11. Timber harvests in Washington and Oregon, 1880-1950, in million board feet.

Despite the unprecedented demand for forest products during the war, rates of harvest in the Northwest remained high but steady through the war years, never increasing beyond the region’s peak harvest in 1929. A number of factors contributed to the relative restraint of the lumber industry. Labor shortages in the forests and mills represented the greatest limitation to lumber production as workers left the woods for the military or better-paying jobs in Portland and Seattle’s war industries. The war also slowed the adoption of new technologies that could

\textsuperscript{158} Greeley, \textit{Forests and Men}, 152-153.

have sped production. The use of trucks and tractors in logging had become commonplace by the
time the war started, but production for the military took precedence, so Northwest loggers were
left with an inadequate supply of equipment and spare parts. The chainsaw, a new technology
only beginning to make its way into the woods as the US entered the war, could have helped to
offset the reduced production due to labor shortages, but the lack of parts and materials impeded
the improvement and dissemination of the tools. Finally, federal conservation policy protected
federal forests in the Northwest from exploitation. The National Park Service prevented
significant incursions into the region’s parks and the Forest Service continued to call for strong
federal regulation of public and private forest lands to prevent mismanagement and waste of
forest resources. As a result, Northwest forests emerged from the war depleted, with rates of
harvest exceeding natural regrowth by three hundred percent. But the forests were not
completely destroyed, and the majority of national forests in the Northwest remained intact.¹⁶⁰
After the war, the availability of and improvement in technology, especially the chainsaw,
increased availability of labor, a shift in culture in the Forest Service toward production rather
than conservation, and a massive demand for lumber for rebuilding Europe and for housing in
the United States led to an increase in harvests in the Northwest, ultimately surpassing the
wartime peak production by 1950.¹⁶¹

Hirt, A Conspiracy of Optimism, 45, 50.

¹⁶¹ For more on the Forest Service in the postwar era, please see Hirt, A Conspiracy of Optimism. US Bureau of the
Census, Statistical Abstract of the United States 1955, “Table No. 881–Lumber Production, By Regions and States:
CHAPTER THREE

“HERE ARE YOUR SHIPS, UNCLE SAM”:
SHIPBUILDING IN THE PORTLAND AND SEATTLE METROPOLITAN AREAS

Introduction

On September 27, 1941, the EC-2-type cargo ship Star of Oregon slid off the slipways and into the Willamette River in Portland, Oregon, to the applause of 25,000 spectators. The Star of Oregon was the first ship launched by the Oregon Shipbuilding Corporation (OSC) and among thirteen other Liberty ships launched across the country that day, proclaimed by President Roosevelt as “Liberty Fleet Day.”¹ Most Liberty ships were named according to the United States Maritime Commission’s naming conventions, which called for ships to be named for Americans who “made a contribution to our country’s own liberty.”² However, the Maritime Commission honored a “special request of the people of Oregon,” to make an exception for the ship, allowing it to bear the name of the first ocean-going vessel built in Oregon, the Star of Oregon. The keel for the second Star of Oregon was laid on May 19, 1941, the hundredth anniversary of the launching of its namesake.³ On its launch day four months later, a large

¹ Lawrence Barber, “25,000 See Launching Of First Liberty Ship In Portland’s Program,” The Oregonian (Portland, OR), September 28, 1941.

² “Star of Oregon: In Vanguard of Twelve ‘Liberty Fleet’ Ships,” Bo’s’n’s Whistle Vol. 1 No. 6 (September 27, 1941): 2-3.

³ “A Little Ship and a Great Adventure,” Bo’s’n’s Whistle Vol. 1 No. 6 (September 27, 1941): 5. The Star of Oregon was built on Swan Island in Portland, the future site of the Kaiser Company’s Swan Island Shipyard. Helen Durrie Goodwin, “Shipbuilding in the Pacific Northwest,” Washington Historical Quarterly 11, no. 3 (July 1920): 185.
crowd, including the head of the Maritime Commission, the governor of Oregon, mayor of Portland, and general manager of the OSC, as well as 700 shipyard employees and their families, gathered to christen and launch the Star of Oregon. Blanche Sprague, the wife of Oregon’s governor, served as the Star of Oregon’s sponsor, smashing a bottle of champagne across the ship’s bow as it slid into the river.4

After its launch, the Star of Oregon returned to OSC to be outfitted and undergo sea trials. On January 1, 1942, the OSC officially delivered the Star of Oregon to the Maritime Commission, which immediately assigned the ship to the States Steamship Company as its operator.5 With its crew of mariners from the Pacific Northwest and cargo hold full of Northwest lumber, the Star of Oregon set out for the Middle East. After delivering the lumber to Aden, the Star moved cargo to and from ports on the Arabian Peninsula and the eastern coast of Africa before rounding the Cape of Good Hope for the return journey to the United States.

Early in the morning of August 30, as the Star of Oregon made its way past the island of Tabago in the Caribbean, a German U-boat fired torpedoes at the ship. The Star quickly took on water and the crew scrambled for lifeboats. Shortly thereafter, the U-boat surfaced and the captain, along with several other crew members, emerged from the ship’s conning tower. They ordered the lifeboats to come alongside the U-boat so they could speak. The commander asked if all the crew had made it onto lifeboats and if they knew which direction to go for help. After the Star’s crew replied in the affirmative, the U-boat submerged and fired a final round of shots into

4 Barber, “25,000 See Launching Of First Liberty Ship In Portland’s Program”; “Launching Day Program,” Bo’s’n’s Whistle Vol. 1 No. 6 (September 27, 1941): 4.

the foundering *Star of Oregon*, making sure the ship sank completely before departing. The Star’s crew floated in their lifeboats for about twelve hours before being sighted by an allied aircraft. At 10:00 that night, an Allied ship picked them up and returned the crew to safety in Trinidad.

The *Star of Oregon* had a career with the United States Maritime Commission “as short as it was busy,” and was thus representative of many of the ships constructed and repaired in the Pacific Northwest during World War II. Shipyards in the Northwest constructed and repaired more than four thousand vessels for the Navy and the United States Maritime Commission from 1940 through the end of World War II. The ships that passed through the ports of Puget Sound and the Columbia River ranged in size and function from small wooden harbor tugs to the battleship West Virginia, sunk at Pearl Harbor on December 7, 1941. The shipbuilding industry in the Northwest grew to become one of the major war industries in the region, with nearly three hundred thousand people working directly for shipyards in the Portland-Vancouver and the Seattle-Tacoma metropolitan areas.

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6 The account of the maiden voyage and sinking of the “Star of Oregon” is taken from “Survivor of U-boat Sinking Relates Weird Experience,” *The Oregonian* (Portland, OR), October 1, 1942; “The ‘Star’ Never Came Home,” *The Oregonian* (Portland, OR), December 27, 1942; and “The Last Voyage of the Star of Oregon,” *Bo’s’n’s Whistle* Vol. 2 No. 24 (December 24, 1942): 4-5.

7 An *Industrial and Administrative History of the Puget Sound Navy Yard, 1891-1945*; Box 5; 13th Naval District, Commandant’s Office; 13ND-5: Wartime Unit Histories; Records of Navy Installations Command, Navy Regions, Naval Districts, and Shore Establishments, Record Group 181 (RG 181), National Archives at Seattle, Washington (NARA Seattle); *Wartime History of the Supervisor of Shipbuilding, United States Navy, Seattle, Washington*; Box 6; 13ND-5: Wartime Unit Histories; RG 181; NARA-Seattle; *World War II History of the Supervisor of Shipbuilding, USN, Portland, Oregon*, Box 6; 13ND-5; Wartime Unit Histories; RG 181; NARA-Seattle.


The shipbuilding industry in the United States was an incredibly complex, highly politicized, and archaic industry, shackled to hundreds of years of tradition and legislation. In order to meet the needs of the war, the industry had to adapt and change. Before the war, industry leaders believed the Northwest to be too distant from supplies of steel and skilled labor to support major shipbuilding operations. But the nation’s desperate need for ships prompted an expansion of shipbuilding beyond the traditional centers on the East Coast and forced shipbuilders to reconsider how to use Northwest resources to their advantage. The wartime boom of the shipbuilding industry in the Northwest contributed to the physical growth of the region’s major metropolitan areas and to the diversification of the region’s economy, generating new networks of capital and materials within the Northwest and beyond. Shipbuilding reshaped the environment of the Pacific Northwest, employing the region’s most plentiful resources in new ways and contributing to the industrialization of the Portland and Seattle metropolitan areas.

**Historical Context**

From its beginnings in the early nineteenth century, the shipbuilding industry in the Pacific Northwest was closely linked to the region’s environment. Northwest forests offered abundant supplies of building materials for use in shipbuilding and repair in established shipbuilding centers like Boston, London, or Hawaii. Northwest timber was also a valuable commodity in its own right, and exporting it to markets in the United States and overseas required the use of ships. Finally, the geography of the Northwest made waterborne transportation either necessary or more cost-effective as a means of moving people and commodities within the region for much of the nineteenth and early twentieth centuries. These environmental and economic factors stimulated the growth of the shipbuilding industry in the
Northwest, setting the precedent for the industry as it existed on the cusp of war in the late 1930s.

British mariners who explored the Pacific Coast and the Salish Sea during the late eighteenth and early nineteenth centuries traveled to the region to identify merchantable commodities. Sea otter pelts quickly became the most valuable export, but soon mariners discovered the favorable qualities of Northwest timber for shipbuilding purposes.\textsuperscript{10} Douglas-fir proved an especially suitable species for the construction of masts and structural elements like spars. The use of Northwest lumber for shipbuilding launched the region’s lumber industry. In 1828, the Hudson’s Bay Company built the Northwest’s first lumber mill near Fort Vancouver, and the next year the first shipment of Northwest lumber sailed from Fort Vancouver to Hawai’i, signaling the start of what would become the region’s most important industry over the next century.\textsuperscript{11} The nascent lumber industry relied entirely on waterborne transportation to bring its goods to market. As logging increased, small shipbuilding enterprises emerged in the Northwest to construct and service the ships hauling local timber. Lumber mills were built around Puget Sound near stands of timber and at sites that offered easy navigation for the sailing ships that would export the lumber. Towns like Port Ludlow, Port Blakeley, and Port Townsend were home to lumber mills and shipbuilding operations, connecting sites of extraction and production with markets.\textsuperscript{12}


While logging expanded in the Puget Sound region in the second half of the nineteenth century, agriculture became as an important industry to the south in the Willamette Valley and to the east in eastern Washington and Oregon. Portland emerged as the center for commercial activity and global trade in the Pacific Northwest. Situated at the confluence of the Willamette and Columbia Rivers, Portland became the hub for the sale and transport of agricultural commodities from the Willamette Valley and Inland Northwest. River transportation was the backbone of this enterprise. Farmers and ranchers in the Willamette Valley, southeastern Washington, and eastern Oregon relied upon barges and boats to bring their wheat and wool to market in Portland. Ship construction and repair businesses began to appear in Portland to support the region’s extractive industries. Portland boomed as a result of its position as the hub for global trade in the Northwest, relying on ships to funnel the products of the region’s extractive industries through the city and on to markets overseas.

By the late nineteenth century, Seattle experienced a commercial boom as well, thanks in large part to the Klondike Gold Rush. In the 1880s, Seattle had positioned itself as the transportation center for moving goods from its hinterland to markets in the US and abroad. With the completion of transcontinental railroad lines connecting Seattle to the East and a growing fleet of ships connecting the city to Alaska, Seattle was well-positioned to take advantage of the Gold Rush beginning in 1897. Seattle became the “gateway” to Alaska, outfitting prospectors as they embarked on their journey to the gold fields. As a result of this growing trade, shipbuilding

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increased and consolidated around the commercial centers of Seattle and Tacoma, rather than around lumber mills, as had been the case earlier in the nineteenth century.\textsuperscript{15} Local craftsmen had plentiful quality building materials nearby and a demand for the types of vessels that could be constructed by smaller manufacturing operations. The Puget Sound area became the center for shipbuilding in the Northwest thanks to nearby sources of building materials and demand for small ships generated by the lumber industry and commercial trade.\textsuperscript{16} By the turn of the century, a small but thriving shipbuilding industry had emerged in the Pacific Northwest, dominated by craftsmen who constructed sturdy vessels from local materials.

The US Navy also became an important part of the maritime environment of the Northwest at the end of the nineteenth century. A naval shipyard in Puget Sound was first proposed in 1867, and a survey team, led by Captain Alfred Thayer Mahan, recommended a site in 1889. In 1891, Congress approved the proposed site and the Navy purchased the land for Navy Yard Puget Sound east of Seattle in what is now Bremerton. Construction of the yard began in 1892 and the first drydock was completed in 1896. A second drydock, completed in 1913, was the largest drydock in the Navy at the time, making Puget Sound the only facility on the West Coast able to accommodate the fleet’s largest vessels.\textsuperscript{17} The Navy intended Puget Sound to expand its ship repair and construction capabilities. The specific mission of Navy Yard Puget Sound changed over time in response to the needs of the Navy.


World War I represented the zenith of wooden shipbuilding in the Pacific Northwest. However, the war also signaled a turning point for the region’s shipbuilding industry as local shipbuilders invested in wooden construction while the rest of the industry turned decisively toward steel-hulled construction, leaving the Northwest behind. During World War I, the Northwest became a center for new ship construction. Given its location far from the battlefront in the Atlantic, the Navy made Navy Yard Puget Sound responsible for new ship construction, while yards on the East Coast focused on repair of battle-damaged vessels. Navy Yard Puget Sound built six submarines, twenty-five sub-chasers, two minesweepers, two ammunition ships, and miscellaneous smaller boats.¹⁸

Private shipyards in the Northwest also constructed new ships during the First World War. The majority of new ship construction took place in the established yards on the East Coast, but Northwest shipbuilders negotiated contracts for a variety of cargo and auxiliary vessels. Indeed, Oregon and Washington led the nation in wooden ship construction during World War I, constructing 259 wooden cargo ships and numerous miscellaneous wooden ship hulls, far more than any other state or region.¹⁹ Shipbuilding in private yards was dominated by the Todd Shipyards Corporation. A prominent East Coast ship repair organization, the Todd Shipyards Corporation expanded its presence by acquiring the Seattle Construction and Dry Dock Company in 1916.²⁰ Although Todd focused primarily on ship repair, as the managers believed “that ship repair work is the only dependable bread and butter for an American shipyard,” the

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organization expanded its operations in the Northwest to construct new ships. The corporation built a new shipyard in Tacoma in 1916 specifically to construct new merchant vessels for the Emergency Fleet Corporation. Seeking to expand its operations, Todd sold the old Seattle Construction Dry Dock Company yard in 1918 and purchased a site on the north end of Harbor Island where it established the Todd Dry Docks Corporation as a ship repair yard. Over the course of the war, Todd and the numerous other shipbuilders in the Northwest constructed 190 steel ships and employed around 70,000 people.

The wartime shipbuilding boom expanded industry in Northwest cities, but the contribution of shipbuilding to the region’s economy did not prove lasting. As the Navy canceled contracts at the end of the war, massive layoffs and labor unrest ensued. The rapid decline of shipbuilding proved detrimental to the region’s industry. Navy Yard Puget Sound continued ship construction and repair operations after World War I and in the Interwar years, but most of the private yards significantly reduced their operations or folded entirely. The Todd Corporation’s yard in Tacoma continued to construct ships until 1925, when all the work the company had contracted for during the war was complete. Once the ships were delivered, the Tacoma shipyard corporation dissolved and in 1933, the shipyard facilities were dismantled. During the 1920s, the shipbuilding industry declined around the country, but regional planners described the

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21 Mitchell, *Every Kind of Shipwork*, 43.


industry in the Northwest as diminished “almost to the point of extinction.” Indeed, the number of people employed in shipbuilding in Washington and Oregon fell from the estimated wartime peak of around 70,000 down to just over 37,000 in 1919, to around 1,600 people in 1929. The number of establishments engaged in shipbuilding also dropped from 106 in 1919 to 66 in 1929. The shipyards that survived the turbulent Interwar years became the foundation for the expanded industry during World War II.

**Interwar Policy**

A series of naval treaties signed by the United States and other world powers in the 1920s and 1930s significantly influenced fleet composition and naval shipbuilding up to the eve of World War II. During World War I, the world’s naval forces built massive fleets and engaged in destructive naval warfare. After the war, the public and world leaders sought to disarm to prevent a future arms race, which they believed had precipitated the previous war. To that end, leaders of the United States, Great Britain, France, Italy, and Japan met to negotiate a treaty to limit the size of their navies. As the largest naval forces in the world, they sought to set an example of disarmament for the rest of the world. The Washington Treaty, signed in 1922, limited the tonnage and armament of the signatories’ navies for a period until 1936. The subsequent London Treaty, signed in 1930, reaffirmed the Washington Treaty and established additional size and composition limitations. As a result of these treaties, the composition of the US Navy was limited to 525,000 tons for capital ships (the fleet’s largest ships, including battleships and

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cruisers), 135,000 tons for aircraft carriers, and was prohibited from constructing new battleships. Throughout the 1920s and early 1930s, the United States refrained from building up to the maximum treaty allowances in number and size of fleet in order to save costs and demonstrate leadership in adhering to treaty policies.27

Domestic policy during the Interwar years also influenced the types of ships constructed and location of construction, establishing the foundation for the merchant and naval fleets at the beginning of World War II. The shipbuilding industry was a highly complex, segmented, and regulated industry, with laws and traditions dating to the eighteenth century that still influenced shipbuilding in the twentieth century. For example, the Merchant Marine Act of 1920 reaffirmed the laws in place since 1789 that prohibited vessels that were built in or operated by other nations to operate in the domestic trade in the United States.28 Thus both naval and those merchant vessels destined for domestic trade had to be constructed in the United States. Construction costs for ships in the US were very high and the process was relatively slow. Builders worked on one ship at a time in a craft-based construction process. Due to the expense of ship construction, most new naval warships were built at the Navy’s shipyards during the 1920s.29 The navy constructed few ships during the 1920s, as appropriations fell from a peak in 1919 of $1.9 billion to a low in 1924 of $302 million.30


The New Deal

Between 1933 and 1939, President Roosevelt signed a series of bills aimed at industrial recovery and the enlargement of the nation’s naval and merchant fleets. Roosevelt sought to support the shipbuilding industry during the Great Depression in order to maintain employment levels at shipyards and in their supporting industries. The National Industrial Recovery Act of 1933 included a provision that authorized $238 million for the construction of thirty-two naval ships.\(^\text{31}\) The Vinson-Trammell Act of 1934 authorized the Navy to build up to treaty limits, which it had not done in the 1920s. The Act also delineated the specific types of vessels to be constructed, rather than providing funding for construction up to a certain amount of deadweight tons with the Navy to decide how to divide it up between certain vessels. A significant provision in the Act required that each first vessel of a type and every other subsequent vessel, so half of every type of vessel, must be constructed in a navy yard rather than a privately-owned shipyard.\(^\text{32}\) This provision was intended to save on costs, create jobs, and distribute the work across the country, otherwise much of the construction would be concentrated on the East Coast. However, the Vinson-Trammell Act of 1934 merely authorized the construction of new ships; it did not provide funds to complete the construction program. As a Navy historian explained in 1945, “Naval appropriations were passed and projects undertaken, not so much in pursuance of a policy of naval preparedness, but as a means of alleviating unemployment.”\(^\text{33}\)


\(^{33}\) *An Industrial and Administrative History of Puget Sound Navy Yard*, 91; Box 5; 13ND-5: Wartime Unit Histories; RG 181; NARA Seattle.
Another New Deal-era piece of legislation that significantly influenced shipbuilding was the Merchant Marine Act of 1936. The Act was intended to encourage the construction of new merchant vessels to modernize the fleet and replace the thousands of World War I surplus vessels still at sea, to lower the cost of construction, and to create jobs. Recognizing that the cost of building ships in the United States was much higher than in other nations, Title V of the act provided subsidies for shipbuilders constructing ships in the United States for foreign trade to make up for the difference between the cost of domestic versus foreign construction. The cost differential was initially set at 33.5 percent, but could be raised up to 50 percent. The Act also required that American-flagged ships built in the US for the foreign trade that received a cost differential be retired and replaced when twenty years old. To aid ship owners in complying with the statutory obsolescence requirement, the Merchant Marine Act provided ship owners with a credit for obsolete vessels that they could put toward the cost of construction of a new vessel in a US yard. Furthermore, recognizing the higher costs for shipbuilding on the West Coast, the Merchant Marine Act offered a lower interest rate and deferred payments for ship owners operating out of Pacific Coast ports in foreign or domestic trade whose businesses were established after 1935.\(^{34}\) Finally, the Merchant Marine Act established the United States Maritime Commission, which replaced the United States Shipping Board. The Maritime Commission was charged with administering the provisions of the Act, creating a training program for merchant mariners, and managing a shipbuilding program that would stimulate the

economy and modernize America’s merchant fleet by using federal funds to construct ships and lease them to private operators.\textsuperscript{35}

The Merchant Marine Act of 1936 created a market for new construction through the statutory obsolescence provision for merchant vessels and the Maritime Commission’s shipbuilding and leasing program. The Act also helped to make American shipbuilding more competitive with foreign shipbuilding operations by providing subsidies to make up the difference in cost. The benefits were not equally shared across the country, however. Well-established shipbuilding firms on the East Coast tended to receive most of the business created by New Deal-era shipbuilding legislation.\textsuperscript{36} One of the overarching goals of the Merchant Marine Act was to build up the nation’s merchant fleet in order to make it safer, more competitive, and available for national defense needs.\textsuperscript{37} As the authors of the Act stated, having a modern, effective merchant marine was crucial in order to be “capable of serving as a naval and military auxiliary in time of war or national emergency.”\textsuperscript{38} These measures set the stage for how shipbuilding operated at the beginning of World War II.

Planning for War

Changes to the United States’ war plans over the course of the Interwar years made the location of the Northwest more strategically important. During World War I, nearly all of America’s military focus was on Europe and the naval war in the Atlantic. Therefore, the bulk of

\textsuperscript{35} Whitehurst, \textit{The US Shipbuilding Industry}, 37.

\textsuperscript{36} Walters, “American Naval Shipbuilding,” 423-424.


\textsuperscript{38} United States Maritime Commission, \textit{Merchant Marine and Shipping Acts}, 1.
ship repair activities took place on the East Coast and the shipyards on the West Coast were tasked with new ship construction.\textsuperscript{39} During the 1920s, the little shipbuilding activity that occurred was mostly on the East Coast in the traditional shipbuilding areas. In the 1930s however, geopolitics changed. Throughout this decade, the Navy and later the Army and Navy Joint Planning Committee, developed a series of plans for a possible war with Japan, known as War Plan Orange. War Plan Orange assumed a naval war with Japan, where the opposing nations’ capital ships did battle across the vast Pacific Ocean.\textsuperscript{40} After war broke out in Europe, the Joint Planning Committee devised the Rainbow war plans, which imagined a simultaneous two-front war against Japan in the Pacific and Germany and Italy in Europe. These plans called for the protection of the Northern Pacific and Alaska to prevent Japanese forces from gaining entry to North America through Alaska and the Northwest.\textsuperscript{41} With such a war in mind, the navy shipyards at Pearl Harbor, Mare Island, and Puget Sounds would play essential roles, providing repair services for the battle-damaged fleet.

While naval planners crafted war plans to guide the direction of military preparedness in the 1930s, regional planners worked on the local level to promote the strategic development of the Northwest’s natural, human, and economic resources. Planners were concerned with the region’s reliance on extractive industries, especially logging and agriculture, and the consequences of that pattern on the local economy and environment. The construction of

\textsuperscript{39} Puget Sound Naval Shipyards, \textit{Puget Sound Naval Shipyards}, 12.


\textsuperscript{41} Davidson, \textit{The Unsinkable Fleet}, 13-14; Steven T. Ross, \textit{American War Plans, 1890-1939} (London: Taylor & Francis Group, 2002), 165-166.
Bonneville and Grand Coulee Dams became the cornerstone of plans to diversify the region’s economy. Regional planners sought to encourage the development of manufacturing industries that would use local resources, especially minerals, lumber, and electricity. Aluminum production fit planners’ vision for the Northwest, but shipbuilding did not.\textsuperscript{42}

With the dramatic collapse of shipbuilding after World War I still fresh, planners viewed the industry with suspicion. Conventional wisdom held that the Northwest was too far from sources of steel to support a modern shipbuilding industry. Indeed, as late as 1939, as much ninety-five percent of the materials used in steel ship construction on the West Coast had to be imported from the Midwest and East Coast.\textsuperscript{43} The expenses associated with transporting building materials to the Northwest and the finished ships to operators made the cost of ships prohibitively expensive and Northwest shipbuilders were unable to compete with the established yards on the East Coast.\textsuperscript{44} But the war upended this logic, imposing new demands and considerations. Resources that planners and industry leaders had overlooked in the Interwar years, i.e, waterfront land along deep water ports, plentiful lumber, and inexpensive electricity, suddenly became assets that drew shipbuilding to the Northwest as the nation prepared for war.

**Wartime Shipbuilding and Repair**

When war broke out in Europe in 1939, the shipbuilding industry was beginning to emerge from the Great Depression. In 1938, the Navy and Maritime Commission embarked upon

\textsuperscript{42} For more on planning, please refer to chapter one.


ten-year building programs to modernize and expand their fleets.\textsuperscript{45} While this influx of orders for new ships helped to revitalize the industry, the contracts were not distributed evenly to shipyards across the country and instead concentrated on the East Coast. Indeed, the Navy promoted the geographical division of shipbuilding up until the beginning of the war. In 1937, the Acting Secretary of the Navy wrote a letter to the Puget Sound Navy Yard League explaining that “it is the Navy Department’s policy to concentrate its new ship building at Atlantic Coast yards to compensate for the fact that repair work on the Fleet is confined almost exclusively to the Pacific Navy Yards.”\textsuperscript{46} In June 1938, the Secretary of the Navy reaffirmed this policy, explaining that the “primary mission” of West Coast naval shipyards “is the maintenance and material improvement of vessels of the US Fleet.” He continued, “shipbuilding and manufacture shall be carried on only to such an extent as will increase the industrial facilities and personnel, add to their ability to more nearly meet the peak loads during mobilization, as well as not interfere with the maintenance and improvement of vessels.”\textsuperscript{47}

This disparity in the distribution of contracts did not escape the notice of Western lawmakers. In early 1939, Representatives Richard J. Welch of California and Warren G. Magnuson of Washington introduced legislation to fund the construction or acquisition of four shipyards in San Francisco, Los Angeles, and Seattle to support the West Coast shipbuilding industry. Through the hearings for this legislation, it became clear that the industry leaders were determined to keep their major operations on the East Coast. Indeed, an article in \textit{The Nation}

\textsuperscript{45}Davidson, \textit{The Unsinkable Fleet}, 11; Kilmarx, \textit{America’s Maritime Legacy}, 175.

\textsuperscript{46}Quoted in \textit{An Industrial and Administrative History of Puget Sound Navy Yard}, 99; Box 5; 13ND-5: Wartime Unit Histories; RG 181; NARA Seattle.

\textsuperscript{47}Quoted in \textit{An Industrial and Administrative History of Puget Sound Navy Yard}, footnote 2, 92-93.
argued that the largest shipbuilding companies, like Todd Shipyards, conspired to fix prices, keep contracts away from West Coast yards, and make undue profits from government contracts. Although Welch’s and Magnuson’s bills did not pass, they highlighted the disparity in the shipbuilding industry and revealed the industry’s intent to maintain the status quo even as war approached.

As the war in Europe escalated, Congress appropriated funds to further expand America’s merchant and naval fleets. In June 1940, President Roosevelt signed a bill to increase the size of the Navy by 11 percent of its deadweight tons. Just one month later, after the fall of France, Congress passed an appropriation bill that allowed for a 70 percent expansion of the Navy, increasing the tonnage of new construction from 1.5 million deadweight tons to 3 million tons. Additional appropriations in 1942 granted another 200,000 tons for the construction of submarines, 1.2 million tons for auxiliary vessels, and 1.9 million tons allocated to specific ships. The June 1942 legislation was the last naval expansion package during the war. Since new ship construction took so long, that funding would provide for all the ships that could be built before the war ended.

Although the expansion bills in the 1930s called for half of the new ships to be constructed in Navy yards, it was clear by 1940 that Navy yards would be unable to accommodate the increased schedule of shipbuilding. The Navy recognized that the bulk of the burden of new ship construction and the accompanying shipyard expansion would have to be

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50 Davidson, *The Unsinkable Fleet*, 35-36.
done by private shipbuilders. Thus, in August 1940, Secretary of the Navy Frank Knox reduced the percentage goal to 15 to 20 percent of ships to be constructed in government yards.\textsuperscript{51} The most expeditious means of producing new ships was to use existing facilities. Up to 1940, most of the new ship construction had been accomplished by the Navy’s shipyards and a handful of private shipyards, concentrated in the mid-Atlantic region. However, the number of ships required by the Navy in the summer of 1940 and the speed in which they were needed was beyond the capacity of the existing shipyards. The urgent need to build as many ships as possible as quickly as possible forced government and industry leaders to think more creatively about how to use the nation’s resources. Suddenly the draw of available waterfront land in Northwest cities outweighed the previously insurmountable problem of geography, as the need for slipways eclipsed consideration of transportation costs.

The Navy turned to the West Coast in desperation for new shipyards. In August 1940, the Bureau of Ships established a Supervisor of Shipbuilding office in Seattle to survey existing shipbuilding facilities from Bellingham, Washington, south to Portland to identify potential contractors for the Navy’s expansion program.\textsuperscript{52} Commander W.J. Malone, who completed the survey was not impressed by what he found. In his report, he determined that “none of the yards in the Seattle area had even reasonable facilities for carrying on the Navy shipbuilding program in the Pacific Northwest.”\textsuperscript{53} Navy Yard Puget Sound had “reasonable facilities” but was already engaged in the construction of six new destroyers, in addition to its primary mission of ship

\textsuperscript{51} Davidson, \textit{The Unsinkable Fleet}, 57.

\textsuperscript{52} \textit{Wartime History of the Supervisor of Shipbuilding}, United States Navy, Seattle, Washington, 1, 9; Box 6; 13ND-5: Wartime Unit Histories, RG 181; NARA Seattle.

\textsuperscript{53} \textit{Wartime History of the Supervisor of Shipbuilding}, United States Navy, Seattle, 14.
repair. In order to undertake the massive new construction program, the Navy needed to expand the existing shipyards in the Northwest. Commander Malone recommended that three shipyards in Portland and five shipyards in the Seattle-Tacoma metropolitan area be expanded and improved to meet the needs of the navy’s production requirements. These shipyards laid the foundation for the explosive growth of new ship construction and ship repair in the Puget Sound region and the Portland metropolitan area during World War II.

Shipbuilding in Seattle

The five private shipyards in the Seattle-Tacoma metropolitan area identified in Commander Malone’s survey, along with Puget Sound Navy Yard, dominated the landscape and seascape of shipbuilding in the Puget Sound area. Of the private shipyards, the two new ship construction yards and one repair yard operated by the Todd Shipyards Corporation became the largest private shipyards in the region. The operations of the Todd yards and Navy Yard Puget Sound reshaped the environments in Seattle, Tacoma, and Bremerton and left a lasting impact on the physical and economic landscape of the Puget Sound area.

Navy Yard Puget Sound was the first shipyard in the Northwest to play a role in the Navy’s wartime shipbuilding program. The Yard served as the Navy’s primary repair yard on the West Coast due to its protected, deep-water port. Indeed, Mare Island in California, the West Coast’s other major naval shipyard, was so shallow and silty, it could not accommodate ships larger than a cruiser. New Deal funding enabled the yard to expand to improve its capabilities

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54 Administrative History of Puget Sound Navy Yard, 99.

55 Wartime History of the Supervisor of Shipbuilding, United States Navy, Seattle, 2.

for ship repair and construction and as a job-creating measure. The Works Progress Administration built new roads and repaired railroad tracks. Beginning in 1939, workers constructed two new one thousand foot long drydocks, enabling the Yard to accommodate the fleet’s largest, most modern ships. Prior to the war, most repair work centered around the modernization of the Navy’s older capital ships, including aircraft carriers, battleships, and heavy cruisers.57

Major ship repair operations began immediately upon the outbreak of war. Five of the seven battleships damaged or sunk at Pearl Harbor on December 7, 1941, were eventually floated and brought to Puget Sound for repair. The battleships Tennessee and Maryland suffered the least amount of damage. The two ships began repairs at Puget Sound in late December 1941 and returned to the fleet at the end of February 1942, only 53 days after arriving at Puget Sound. Six thousand workers contributed to the rapid repair of the two battleships.58 The battleship Nevada was severely damaged at Pearl Harbor, but not sunk. The Nevada arrived at Puget Sound for repairs in May of 1942 and returned to the fleet that December. The battleships California and West Virginia were sunk during the attack at Pearl Harbor. It took eighteen months for repair crews to raise the sunken ships and for the ships to make their way to Puget Sound for repairs. Both battleships steamed to Puget Sound under their own power. The California began repairs in October 1942 and returned to the fleet in January 1944. The West Virginia, which had been at Puget Sound for overhaul prior to the war, began repairs in May 1943 and returned to duty in


58 An Industrial and Administrative History of Puget Sound Navy Yard, 185.
July 1944.\textsuperscript{59} The repair and reconstruction of the battleships damaged and sunk at Pearl Harbor was a major job for the shipyard and lasted nearly three years. An average of 2,972 people worked on the battleships for a total of nearly $33 million just for the cost of labor.\textsuperscript{60} The repairs to the battleships damaged and sunk at Pearl Harbor accounted for only a small amount of the repair work done at Navy Yard Puget Sound during World War II. From January 1, 1940 to the end of the war, workers repaired more than four hundred ships at Puget Sound. The bulk of these were the fleet’s major capital ships, including battleships, cruisers, and seven of the fleet’s aircraft carriers, along with destroyers and submarines.\textsuperscript{61}

Shipwrights at Navy Yard Puget Sound also constructed a limited number of new ships during the 1930s and through the end of the war. The Navy kept the contracts for aircraft carriers, heavy cruisers, and other larger ships with private and Navy yards on the East Coast, where these types of ships had been built for decades. Newer, smaller ships, such as destroyers, were assigned to other yards distributed across both coasts. In order to keep the Yard’s skilled labor force employed in the 1930s, the Navy assigned the construction of five new destroyers to Puget Sound. Over the course of the war, workers at Puget Sound built eight additional destroyers, eight destroyer escorts, five escort aircraft carriers, and thirty-two other smaller ships including seaplane tenders and barges.\textsuperscript{62}


\textsuperscript{60} Administrative History of Puget Sound Navy Yard, 184.


To meet the needs of the wartime ship construction and repair programs, the facilities of Navy Yard Puget Sound were continually expanded and modernized throughout the war. The shipyard grew from 286 to 338 acres over the course of the war. At the start of the limited national emergency in 1939, much of the facilities of the Navy Yard were fairly old, of pre-World War I construction. Beginning in 1939 and continuing throughout the war, new industrial buildings were constructed and existing buildings expanded and modernized to meet the mission of the Yard. A new smith shop, ship fitters’ shop, machine shop, galvanizing plant, and heavy forge shop were built. Workers also constructed two new shipbuilding ways and an outfitting quay and pier. Employment at Puget Sound increased from 6,000 in 1939 to 32,500 at its peak in 1945. The shipbuilding and repair work at Navy Yard Puget Sound contributed to the success of the US Navy’s Pacific fleet and expanded the footprint of the modern shipbuilding industry in the Puget Sound area.

Private shipyards around Puget Sound also engaged in ship repair work. The largest of these yards, Todd-Seattle Dry Docks Corporation, was built on Harbor Island in Seattle during World War I. The yard sustained itself during the Interwar years doing heavy repairs and reconstruction on ships for the United States Shipping Bureau and on the growing “mosquito fleet” of automobile and passenger ships that steamed around Puget Sound. The profits from these repair and conversion activities enabled the yard to construct a new 16,000-ton floating dry dock in 1935, replacing an older, smaller dock. Although the workforce dropped to a low of

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63 Bureau of Yards and Docks, Building the Navy’s Bases in World War II, 194.


375 people between 1935 and 1939, the infrastructure and expertise of the remaining shipwrights enabled Todd-Seattle Dry Docks to play a significant role in the repair of Allied vessels during the war. The type of work done at Todd-Seattle Dry Docks did not differ much from what it had done during peacetime, however the quantity and types of ships that the workers at the yard repaired greatly expanded. Over the course of the war, shipwrights at Todd-Seattle Dry Dock Corporation repaired and converted 1,900 ships, including more than 1,000 Liberty ships and other large cargo ships. Although this was the lowest number of repairs completed among all of Todd’s five repair yards, it was the second highest in terms of deadweight tons due to the size of ships handled at the Seattle yard.\(^66\) The expanded ship repair facilities made Todd a permanent feature of Harbor Island.

The Todd Shipyard Corporation saw the impending war as an opportunity to revive its new ship construction operations. The Seattle-Tacoma Shipbuilding Corporation (STSC) incorporated in July 1939 with two division, Seattle Division and Tacoma Division, to run new ship construction yards in those cities.\(^67\) The Todd Corporation partnered with Six Companies, the conglomerate led by Henry Kaiser created in the 1930s to construct Boulder Dam, and thirty other organizations to form the Seattle-Tacoma Shipbuilding Corporation.\(^68\) The Todd Corporation, which was half owner of the conglomerate, took charge of the shipbuilding operations, while Six Companies constructed the yards.\(^69\)

\(^{66}\) Mitchell, _Every Kind of Shipwork_, 159-160.

\(^{67}\) _The History of the Supervisor of Shipbuilding, USN, Tacoma, Washington_, 35; Box 7; 13ND-5: Wartime Unit Histories; RG 181; NARA Seattle; “The Earth Movers II: They Turn to Shipbuilding and Change the Face of the West,” _Fortune_ (September 1943): 222.

\(^{68}\) Mitchell, _Every Kind of Shipwork_, 122.

\(^{69}\) “The Earth Movers II,” _Fortune_ (September 1943): 222.
In October 1939, the Seattle-Tacoma Shipbuilding Corporation won a contract with the Maritime Commission to build five C-1 cargo vessels. The company selected the site of the Todd yard in Tacoma, originally built in 1917 but dismantled in the Interwar years, as the location for the new shipyard to build the cargo ships. The Maritime Commission provided funding to STSC for construction of the yard. Nearly $8 million went into the construction of five shipways, outfitting berths, other buildings, docks, cranes, and other equipment. The new yard began operations in March 1940, and in 1941 won additional contracts with the Maritime Commission for thirty-six C-3 freighters. In March 1941, STSC secured its first contract with the Navy to build gasoline tankers. By October 1942, the Navy took over operations at the yard from the Maritime Commission because the number of Navy contracts had eclipsed Maritime Commission orders. The yard then turned from building cargo ships to constructing escort aircraft carriers.

When the STSC’s Tacoma yard came under Navy supervision, the Navy authorized further expansion and construction of the yard’s facilities. The Navy proved an additional $6,352,000 for expanded yard facilities, structures, and equipment, bringing the yard up to eight shipways and three outfitting piers. In total, between 1939 and 1945 the government spent

70 *The History of the Supervisor of Shipbuilding, USN, Tacoma*, 2; Mitchell, *Every Kind of Shipwork*, 66.


72 Mitchell, *Every Kind of Shipwork*, 123; *The History of the Supervisor of Shipbuilding, USN, Tacoma*, 2-3; 36-37.


74 *The History of the Supervisor of Shipbuilding, USN, Tacoma*, 37-38; “Present Plan of Yard, Plot Plan, Seattle Tacoma Shipbuilding Corp., Tacoma, Wash., Nov. 25, 1943,” Box 525; Regional Office – Seattle, Real Property Case Files; Records of the War Assets Administration, Record Group 270 (RG 270); NARA Seattle.
more than $14 million on facilities and equipment for the Tacoma yard.\textsuperscript{75} STSC’s Tacoma yard was designed for welded construction and was hailed by boosters as “one of the first in the country to be laid out scientifically and specifically for welded ships.”\textsuperscript{76} Industry experts explained that the yard “started as a model yard for the Maritime Commission’s 500-ships-in-ten-years plan… and the general lay-out has been freely copied by many of the newer West Coast yards.”\textsuperscript{77} Over the course of the war, the Tacoma yard constructed around seventy-five ships, including forty-nine escort aircraft carriers.\textsuperscript{78}

The Seattle-Tacoma Shipbuilding Corporation shipyard in Seattle on Harbor Island was built in 1941 by the Navy for the purpose of constructing new destroyers. The shipyard was owned jointly by the STSC and the Navy and cost the Navy more than $8 million to construct. The yard consisted of Plant A, the ship construction yard at the northeast corner of Harbor Island, and Plant B, added in 1942 for the purpose of outfitting the newly-built destroyers.\textsuperscript{79} As the Allies went on the offensive in the Pacific Theater in 1943 and more ship repairs became necessary, the Navy shifted the focus of the work at the Seattle yard to include ship repair

\textsuperscript{75} Fassett, \textit{The Shipbuilding Business in the United States of America}, 163.

\textsuperscript{76} Ritchie, \textit{The Pacific Northwest Goes to War} (Seattle: Associated Editors, 1944), 23.1


beginning in August 1944. Over the course of the war, shipwrights constructed forty destroyers at STSC’s Seattle yard, and repaired numerous other ships.\footnote{Wartime History of the Supervisor of Shipbuilding, Seattle.}

Figure 12. USS *Little*, a destroyer built at Seattle-Tacoma Shipbuilding Corporation’s Seattle yard, transiting Puget Sound, 1944. Naval History and Heritage Command, photo NH 107134.

In addition to the shipyards owned and operated by the various entities of the Todd Corporation, numerous smaller shipyards around Puget Sound constructed ships for the Navy and Maritime Commission. For example, the Navy financed the construction of the Everett Pacific Shipbuilding and Dry Dock Company in Everett, Washington, for $8 in 1942. Shipwrights at Everett built a variety of auxiliary vessels for the Navy, including barges, lighters, tug boats, and net layers.\footnote{Fassett, *The Shipbuilding Business in the United States of America*, 164; Supervisor of Shipbuilding Seattle, NARA.} Lake Washington Shipyards, across Lake Washington from Seattle in Houghton, received funding from the Defense Plant Corporation to expand its yard. Employment grew from a few hundred to more than eight thousand workers in order to build seaplane tenders.
and other auxiliary vessels for the Navy.\textsuperscript{82} Other shipyards around Puget Sound built a wide variety of vessels, including steel-hulled and wooden-hulled minesweepers, tug boats, oil and gas barges, picket boats, destroyer tenders, lighters, and subchasers. Over the course of the war, shipyards in the Puget Sound area constructed nearly one thousand new ships for the Army, Navy, and Maritime Commission.\textsuperscript{83}

Shipbuilding in Portland

The character of the wartime shipbuilding industry in the Portland metropolitan area differed greatly from that in the Puget Sound region. Only a small shipbuilding industry had survived in Portland after World War I. Indeed, in 1939 Portland had only three shipyards, employing a mere 175 people.\textsuperscript{84} Like Puget Sound, the Willamette and Columbia Rivers that flowed through Portland offered a suitable location for shipbuilding, with deep, protected harbors able to accommodate large ships. The three extant shipyards identified by the Supervisor of Shipbuilding in September 1940, Albina Engine and Machine Works, Commercial Iron Works, and Willamette Iron and Steel Corporation, produced the first ships for the Navy in Portland during World War II. However, the activity of these shipyards soon became overshadowed by the three new massive shipyards operated by the Kaiser Company. These shipyards transformed

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\textsuperscript{83} Supervisor of Shipbuilding Seattle and Supervisor of Shipbuilding Tacoma
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the waterfronts of Portland, Oregon, and Vancouver, Washington while producing nearly nine hundred ships for America’s Navy and Merchant Marine.85

Figure 13. Oregon Shipbuilding Corporation, Portland, Oregon, 1942. Box 184; Oregon Shipbuilding Corp. Portland, Oregon; Regional Office – Seattle, Real Property Case Files; Record Group 270, Records of the War Assets Administration; National Archives at Seattle.

In the late 1930s, Henry Kaiser, whose company was a major contractor in the construction of Bonneville and Grand Coulee Dams, sought to diversify his interests, following his adage: “before you work yourself out of the last job, line up a bigger one to pull yourself out.”86 After establishing the Seattle-Tacoma Shipbuilding Corporation with Six Companies and Todd, and successfully winning the bid for constructing cargo ships for the Maritime Commission, Kaiser sought additional shipbuilding contracts. In December 1940, the Todd-

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Kaiser consortium signed a contract to construct sixty cargo ships for the British, with the understanding that half would be built at the newly-formed Todd-Bath Iron Shipbuilding yard in South Portland, Maine, and the other half built at the new Todd-California Shipbuilding Corporation yard in Richmond, California. In January 1941, the Maritime Commission contracted with several shipyard operators to construct nine new shipyards. Two were Todd-Bath and Todd-California, and three others were Todd-Kaiser consortium yards in California, Texas, and Oregon. As the work progressed, Kaiser and Todd leadership became increasingly at odds. Six Companies executive Felix Kahn explained that, “the Todd crowd decided we were too impulsive… No doubt we were.” At the same time, however, “the westerners thought the easterners were cautious and hidebound.” The conglomerate split in early 1942, when Kaiser bought out Todd’s interests in the Oregon and California shipyards, and Todd bought out the other companies’ interests in the Seattle-Tacoma Shipbuilding Corporation, Texas, and Todd-Bath yards.

The Maritime Commission funded construction of Kaiser’s new shipyard in Oregon, the Oregon Shipbuilding Corporation (OSC), in early 1941. The site selected for the shipyard, located in the St. Johns area of Portland along the Willamette River near the Portland grain terminal, consisted of 180 acres of “mud flats and swamps.” The Port of Portland dredged out a

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88 Levine and Platt, 177-178.


90 Mitchell, 137.

portion of the river to use as the outfitting basin and the dredged material was used as fill to create an even landscape for the shipyard site safely above the flood level for the Willamette. The construction of the shipyard required moving 3.5 million cubic acres of dirt and driving 30,000 pylons into the ground. Construction cost the Maritime Commission more than $23 million. Kaiser pioneered new mass production techniques at the Oregon Shipbuilding Corporation, constructing 330 Liberty ships and ninety-nine Victory ships in less than four years.

In 1942, Kaiser expanded his shipbuilding enterprise in Oregon by establishing two new shipyards. The Kaiser-Vancouver yard in Vancouver, Washington, across the Columbia River from Portland, was built at a cost of $24 million by the Maritime Commission for the construction of escort aircraft carriers for the Navy. The first ship completed, the USS Casablanca, was christened by Eleanor Roosevelt in April 1943. Other ships built at the Vancouver yard included landing ships for the Navy and troop ships for the Army. The Maritime Commission spent an additional $22 million in 1942 to construct the Kaiser-Swan Island shipyard on Swan Island in Portland. To accommodate the shipyard, the City of Portland

92 Charles Mann, “Emergency Shipyard of the Pacific Northwest,” Marine Engineering and Shipping Review
96 Ships for Victory, Box 4 MSS2547 Oregon Shipbuilding Corporation, Oregon Historical Society, Portland, Oregon.
had to relocate its municipal airport. At the Swan Island shipyard, workers built 147 tankers for
the Maritime Commission.\textsuperscript{98} The Kaiser shipyards created an entirely new industrial
infrastructure in the Portland metropolitan area, and in the process, built nearly eight hundred
new warships and merchant vessels.\textsuperscript{99} Unlike the shipbuilding operations in the Puget Sound
region, where existing shipyards formed the basis of wartime ship production, shipbuilding
activities in the Portland metropolitan area produced extensive new facilities at much greater
expense.

\textbf{Local Resources in Shipbuilding}

The Pacific Northwest had very little modern shipbuilding infrastructure when the Navy
and Maritime Commission’s shipbuilding programs got underway on the eve of war. Planners
and industry leaders did not envision the expansion of ship construction on the West Coast.
Indeed, the Navy planned for the majority of its’s construction program to occur in East Coast
yards while West Coast yards were reserved for ship repair. However, the East Coast yards could
not accommodate the increased construction load alone, so the Navy and Maritime Commission
turned in desperation to the West Coast. The problems of West Coast shipbuilding lamented by
traditional East Coast shipbuilders, particularly the distance from sources of steel and iron,
became less important by the time production began to ramp up in the late 1930s. Changing
technology and techniques in ship construction favored the resources available on the West
Coast, particularly in the Pacific Northwest. Power and wood became the key resources plentiful

\textsuperscript{98} Fassett, 164; \textit{World War II History of the Supervisor of Shipbuilding, Portland, Oregon}.

\textsuperscript{99} Fischer, \textit{A Statistical Summary of Shipbuilding under the U.S. Maritime Commission; World War II History of the
Supervisor of Shipbuilding, Portland, Oregon}. 
in the Northwest that drew the shipbuilding industry to the region and contributed to its growth and success during the war.

Electricity

During World War I, prior to the adoption of welding techniques for ship construction, an average ship of approximately the same size as a World War II Liberty ship required the use of more than 900,000 rivets to secure the sections of the ship’s hull together. Not only did this method require the use of massive amounts of steel for the rivets, it also added to the overall weight of the vessel and contributed to the lengthy time that it took to construct a ship. In assembling a ship using rivets, steel plates needed to be cut and shaped to the specifications of the hull design, then holes drilled in specific places along the plates where plates were joined. Thousands of rivets needed to be formed then driven into the plates and caulked to ensure the seal was water-tight. Such techniques relied heavily upon two critical resources that were in short supply once the shipbuilding program began in earnest in 1941: steel and time. Every rivet used represented steel that could not go into the steel plates necessary for the structure of the vessel and time lost in delivering cargo and firepower to the battlefronts.

With the introduction of electric welding techniques for shipbuilding beginning in the 1930s, the number of rivets used in ships declined dramatically and the rate of production increased. The Maritime Commission declared in 1941 that “the most important development in speeding up ship construction has been the replacement of the riveter by the welder.”

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100 J.H. Walker, “Hatching the Ugly Ducklings,” *Popular Science* 141, no. 3 (September 1942): 82.

101 “Half-Million Tons of Steel Saved by Welding in 705-Ship Program,” *Marine Engineering and Shipping Review*, (September 1941), 71.

than securing sections of steel plate together with rivets, electric welding bonded sections of steel plate by fusing them together with a weld metal. The weld metal was placed at the joint where the two plates meet, then heated using an electrode to melt the edges of the joint and fuse with the weld metal.\textsuperscript{103} Electric welding enabled shipbuilders to use less of the material that was most scarce in the Northwest, steel, and to take advantage one of the most plentiful resources in the region, inexpensive electricity. Shipbuilding became an important market for the electricity generated by Bonneville and Grand Coulee Dams. Indeed, BPA even produced a film, “Power Builds Ships,” to demonstrate one of the most important ways that BPA power contributed to the war effort.\textsuperscript{104}

Electric welding reduced the number of rivets used in the construction of a Liberty ship from around 900,000 to 55,000.\textsuperscript{105} Welding was also the primary mode of construction on naval vessels. Welders estimated that around fifteen to twenty miles of welding were used to assemble a modern destroyer.\textsuperscript{106} Industry experts studying ship construction techniques found that the use of welding rather than riveting saved between 7.5 and 25 percent of the total steel used on a typical ship.\textsuperscript{107} In 1941, the Maritime Commission estimated that the use of welding in its 705-ship construction program would save more than 500,000 tons of steel, enough to construct an additional 227 cargo ships.\textsuperscript{108} The savings in steel made possible by replacing riveting with

\textsuperscript{104} Bonneville Power Administration, “Power Builds Ships,” (1942).
\textsuperscript{105} Walker, “Hatching the \textit{Ugly Ducklings},” 82.
\textsuperscript{106} “Welding Here, Is a Real Art,” \textit{Sea-Tac Keel} vol. 1 no. 9 (June 5, 1943): 6.
\textsuperscript{107} “Half-Million Tons of Steel Saved by Welding in 705-Ship Program,” \textit{Marine Engineering and Shipping Review}, September 1941, 71.
\textsuperscript{108} “Half-Million Tons of Steel Saved by Welding in 705-Ship Program,” 71.
welding not only enabled more steel to be put into structural components of ships, but also saved in the ship’s weight (displacement tons), providing ships with more load-carrying capacity (deadweight tons). Welding also produced a substantial time savings for shipbuilders over riveting. Indeed, the Bureau of Labor and Statistics estimated that welding required 25 percent less time than riveting in ship construction. BPA estimated that the use of electric welding reduced the time to build a ship from 250 days to as little as 10 days. In its 1941 report to Congress, the Maritime Commission explained that welding saved time because welders could be trained more quickly, welding did not require as many workers as riveting, and welding enabled the use of prefabrication in the construction process.

The use of welding in shipbuilding enabled naval architects to develop new methods of ship construction. Prior to World War II, most ships were erected one part at a time at the shipways. This was a time-consuming process and reflected the shipbuilding industry’s heritage as a craft industry, with most design done by skilled craftsmen concurrent with rather than prior to ship construction. Using welding to secure sections together enabled parts of the ship to be broken down into subassemblies that could be preassembled off the shipways, leading to a more streamlined production process akin to the mass-production techniques employed in other

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112 1941 United States Maritime Commission annual report to congress, 12.

industries like automobile and aircraft manufacture. The development of prefabrication techniques marked a crucial turning point in the shipbuilding industry, transforming methods of production and the landscape of shipyards.

Figure 14. Bonneville Power Administration promotional poster, n.d. Bonneville Power Administration.

Wood

Setting up a shipyard to accommodate prefabrication required not only land but also materials to build the new facilities. The standard construction material for industrial facilities of this type was steel. However, steel was in high demand for the ships themselves, so engineers turned instead to wood. Advances in forest products research in the 1930s, particularly the development of engineered wood products like structural laminated timbers and plywood, enabled engineers to devise ways to substitute wood for steel in structural elements of industrial buildings.\textsuperscript{114} Given their proximity to an abundant supply of lumber, Northwest shipyards were

\textsuperscript{114} Please see chapter two for more on the use of wood as a substitute for steel.
well-positioned to take advantage of wood as a building material. The California Shipbuilding Company shipyards in Richmond, California; Oregon Shipbuilding Corporation, Willamette Iron and Steel Corporation, Commercial Iron Works shipyards in Portland; and Seattle-Tacoma Shipbuilding Corporation yards in Tacoma and Seattle all had significant numbers of wood-frame buildings.115

Using wood for shipyard facilities not only saved steel but saved time as the construction of wood frame buildings was faster. Builders used prefabrication methods for shipyard buildings, just as the shipbuilders used similar methods for ship construction. Carpenters preassembled trusses and other elements at the mill and delivered the finished products to the shipyards for erection.116 Several lumber mills and forest products companies in the Northwest contracted with local shipyards and yards in California to provide trusses for shipyard buildings. At the Seattle-Tacoma Shipbuilding Corporation yard in Tacoma, workers used more than three million board feet of Douglas-fir lumber for construction of the yard’s “principal buildings.”117 At the Oregon Shipbuilding Corporation yard in Portland, most structures were of timber frame construction. Engineers used local Douglas-fir pilings to support “practically the entire plant.”118 The vast majority of the buildings were constructed with Douglas-fir lumber; only the plate shop and fabricating bays were made of steel.119 Timber Structures, Inc. of Portland built the 130-foot 115 “Improved Timber Construction Speeds Expansion of the Shipyards,” Marine Engineering and Shipping Review (July 1941): 83-84.


bowstring trusses for the mold loft building, which were the largest wooden trusses in the shipyard. The same company also built the trusses for the mold loft at the Willamette Iron and Steel shipyard in Portland, as well as for the mold loft building at Associated Shipbuilders in Seattle.\footnote{120}

In addition to its use as a building material for shipyard facilities, wood also played an important role in the ship construction process. Wood was used for the elaborate networks of scaffolding used for the assembly of a ship. Timber industry experts estimated that around 350,000 board feet of lumber went into the construction of one Liberty ship.\footnote{121} Workers also used wood for templates for sheet metal and steel plate and for jigs for building subassemblies. In the mold loft, workers cut enormous templates for various parts of the ship from spruce or sugar pine. The wooden templates then went to the plate shop where workers cut the steel plate from the templates.\footnote{122} Local wood also found its way onto the ships constructed in the Northwest and beyond. Around ten thousand square feet of plywood was used in each Liberty Ship built at Oregon Shipbuilding Corporation. Workers used Douglas-fir plywood for the walls and ceilings of most of the cabins and rooms, stairs, bulkheads, doors, and furniture in the Liberty Ships.\footnote{123} Wood-hulled ships, like minesweepers, tugs, and sub chasers, used massive Douglas-fir timbers for their keels, some measuring as long as 136 feet. The Navy also used Douglas-fir lumber for

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\begin{itemize}
  \item \footnote{120} “Improved Timber Construction Speeds Expansion of the Shipyards,” \textit{Marine Engineering and Shipping Review} (July 1941): 84.
  \item \footnote{121} “How Liberty Ships Are Built, No. 3 of a Series,” \textit{Bo’s’n’s Whistle} May 21, 1942 p. 10; Timber Engineering Company, \textit{The Forest Fights!} (Washington: Timber Engineering Company, 1942), Oregon Shipbuilding Corporation, MSS2547, Box 4 OHS.
  \item \footnote{122} “How Liberty Ships Are Built, No. 3 of a Series,” \textit{Bo’s’n’s Whistle} May 21, 1942 p. 10.
  \item \footnote{123} “Plywood Goes to Sea on Liberty Ships,” \textit{The Timberman} vol. 44 no. 3 (January 1943): 14-15; “Liberty Ship Outfitters,” \textit{The Timberman} vol. 44 no. 10 (September 1943): 52.
\end{itemize}
decking on battleships and aircraft carriers, among other types. Ships like the aircraft carrier Lexington, used more than 250,000 board feet of Douglas-fir for its flight deck.\textsuperscript{124} Although the vast majority of modern naval vessels were no longer made of wood, wood reemerged as an important building material for shipyards and gave shipbuilders in the Northwest an unanticipated advantage in the race to construct and repair the nation’s Naval and merchant fleets.

**Conclusion**

For many observers at the end of the war, the rebirth of the shipbuilding industry in the Puget Sound region seemed inevitable. Boosters promoted the history of the shipbuilding industry in the Northwest and argued that the region’s shipbuilding heritage was the primary driver of its success during the war. For example, H.E. Jamison, Director of Publicity and Press-Relations for the Seattle-Tacoma Shipbuilding Corporation, claimed in 1944 that the success of shipbuilding in Washington state was a result of Washington being “rich in shipbuilding experience and tradition.”\textsuperscript{125} But the Navy was unimpressed with the shipbuilding industry it encountered in the region in 1940. What enabled the industry in the Pacific Northwest to ultimately meet the needs of the war was a combination of an established industry, leadership open to new methods, and government funding. The shipbuilding industry in the Northwest, especially in the Puget Sound region, had a small core of skilled workers and infrastructure from which to build upon. But the existing industry was not so large or entrenched as to mire the entire expansion program in tradition. The relatively modest extant physical infrastructure in the


\textsuperscript{125} H.E. Jamison, “Brief Historical Picture of Washington Shipbuilding,” *Northwest Industry* vol. 3 no. 8 (May 1944): 10.
region allowed for construction of new or expanded facilities to accommodate the physical and organizational changes necessary for modern, efficient shipbuilding as required by the Navy and Maritime Commission. These shipyards and the new methods they employed, including welding and prefabrication, enabled the shipbuilding industry to take advantage of local resources, particularly electricity and wood. Finally, federal funding was essential to the growth and modernization of the region’s shipbuilding industry. The government spent around $1.5 billion on shipyard facilities and naval establishments across the country between June 1940 and November 1945, more than $100 million of which went to the construction of shipyards in the Pacific Northwest.\(^\text{126}\)

Ship manufacturing in the Northwest declined after the war, but the physical infrastructure created during the war remained. The region’s economic and political environment changed as well. The shipbuilding industry and the ancillary manufacturing industries that it supported during the war helped to break the hold that the extractive industries had on the region’s economy and imagination. Shipbuilding and other manufacturing industries could and did survive into the postwar era, building upon the infrastructure and experience gained during the war.\(^\text{127}\) Although East Coast shipbuilders continued to dominate the industry after the war, the wartime shipbuilding activities in the Northwest carved a permanent place for the industry in the region, contributing the Navy’s ability to operate effectively in the Pacific.


\(^{127}\) For example, the Todd Shipyards Corporation shipyards in Seattle and the Kaiser-Swan Island shipyard are now owned and operated by Vigor Industrial. Washington State Ferries have been made at the Todd shipyard in Seattle since 1971, and the Swan Island shipyard is now home to the largest floating dry dock in the United States. Mitchell, 245; Eric Pryne, “Todd Shipyards agrees to be acquired by Portland firm,” Seattle Times December 23, 2010; Vigor Industrial, “The Vigorous: Investing in the Future,” http://vigor.net/vigorous.
CHAPTER FOUR
FORTRESS CITY:
BOEING AND THE TRANSFORMATION OF SEATTLE

Introduction

In February of 1942, the Army Air Force took delivery of B-17E serial number 41-2578 from the Boeing Airplane Company in Seattle, Washington.¹ Six months later, on August 17, 1942, 41-2578, by then christened Butcher Shop, flew across the English Channel with eleven other B-17Es that had rolled off the assembly line in Seattle earlier that spring. Joined by four squadrons of Royal Air Force Spitfire fighters, the group crossed the English Channel en route to a railroad marshalling yard in northern France. Through clear skies at 23,000 feet, the B-17s dropped 30,900 pounds of general purpose bombs on the Sotteville marshalling yard, damaging tracks, railroad cars, and storage and repair sheds.² Turning back toward England, the bombers resumed their formation for the return flight, encountering light resistance from German fighter planes and antiaircraft artillery. Dozens of reporters and photographers met the returning aircrews upon landing at RAF Polebrook in Northamptonshire that evening.³

¹ Individual Aircraft Record Card for 41-2578, United States Air Force Aircraft History Cards Microfilm, Acc. XXXX-0461, National Air and Space Museum, Smithsonian Institution, Washington, DC.


What made this small and seemingly routine operation worthy of such attention? This mission was the first of more than nearly one thousand daytime strategic bombing missions that the US 8th Air Force would undertake during the course of World War II. The twelve B-17s that flew to France that day were the first of thousands of B-17s to make the journey from the United States to England and on to continental Europe as part of America’s strategic bombing campaign. Over the course of the war, B-17s, along with other types of Army Air Force (AAF) bombers, dropped more than 700,000 tons of bombs on targets in the European Theater of Operations.  

*Butcher Shop* would go on to become the longest-serving B-17 in the 8th Air Force, finally scrapped on August 6, 1945, after three years of service. On that same day, Col. Paul Tibbets, the pilot who flew *Butcher Shop* on her first mission, took to the skies a half a world away in another Boeing airplane. Taking off in the early morning hours from Tinian Island in a special-production B-29 designed in Seattle and assembled by the Glenn L. Martin Company in Omaha, Tibbets headed northwest toward Japan. Unlike his first mission with *Butcher Shop*, which was armed with up to five 600-pound bombs, Tibbets’ B-29, *Enola Gay*, carried a single 8,900 pound bomb. Reaching the city of Hiroshima around 8:00 am, the *Enola Gay* dropped her payload and returned to Tinian. Tibbets helped to usher in the era of strategic bombing in a B-17 over France in 1942 and three years later, brought the world into the atomic age when his B-29 released the first atomic bomb on Japan.

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7 Pace, *Boeing B-29 Superfortress*, 107.
The B-17 “Flying Fortress” and B-29 bombers “Superfortress,” designed by the Boeing Airplane Company, represented the backbone of America’s strategic bombing campaign during World War II. Given its relatively isolated situation in the northwestern corner of the United States, far from traditional centers of industry, Seattle seemed an unlikely place for the development of two of the most important weapons in the air war against the Axis. However, since its founding in 1916, the Boeing Airplane Company had made use of the region’s resources to build the infrastructure that became the foundation for the company’s success during World War II. Networks of capital, first from timber extraction and later from the federal government, provided Boeing with the funds to design and build the thousands of long-range heavy bombardment aircraft needed for the war. The production of Boeing aircraft in Seattle during World War II generated lasting changes to the environment and economy of the Northwest by expanding industrial land use in Seattle and contributing to the diversification of the city and region’s economy. The growth of Boeing during the war years, thanks to federal funding, cemented the company in the Northwest and created a lasting military-industrial complex in the region, turning Seattle into Fortress City.

**Historical Context**

Seattle and the Boeing Airplane Company grew up together in the first decades of the twentieth century and ultimately developed a symbiotic yet sometimes contentious relationship. Where Seattle had previously relied primarily upon the lumber industry for the foundation of its economy, by the end of World War II, Boeing had become the city’s largest employer and the city’s fate tied closely to Boeing’s. Although postwar economists and geographers would puzzle over the logic of locating a major airframe manufacturer in the Pacific Northwest, an examination of the history of the Boeing Airplane Company, the nature of the early aircraft
industry, and the reshaping of Seattle’s environment in the early twentieth century illuminate how Boeing worked to position itself as a major contractor on the eve of World War II.  

William Boeing built his aircraft company from the foundation of Seattle’s timber and water resources. The allure of the nation’s largest remaining stands of uncut timber drew thousands of emigrants to the Pacific Northwest at the turn of the twentieth century, including a young William Boeing. Born in Detroit in 1881, Boeing attended Yale University, but left before completing his engineering degree to come to Washington state to learn the timber trade. Boeing’s father, an immigrant from Germany, had made a fortune investing in timberlands in Michigan, Minnesota, California, and Washington. Boeing built upon this inherited wealth, starting with the family timber holdings in Grays Harbor, Washington, accumulating more land in Western Washington, and in 1908, establishing the Greenwood Timber Company. With the profits from his timber company, Boeing indulged in several hobbies. He contracted with the E.W. Heath Shipyard on the Duwamish River south of Seattle to construct a yacht, and later purchased the shipyard. Boeing also became interested in aviation, taking his first flight in 1914, then learning to fly at pioneer aviator Glenn Martin’s school in Los Angeles.

William Boeing’s interest in aviation quickly became a new business venture. In 1915, Boeing and his friend, naval officer Conrad Westervelt, constructed their first aircraft, a biplane with pontoon landing gear which they dubbed the B&W. After the Navy transferred Westervelt

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to the East Coast in 1916, Boeing incorporated the Pacific Aero Products Company to manufacture aircraft. With recommendations from the Navy, Boeing designed a new seaplane and won a contract with the Navy for fifty Model C trainers in 1917. That same year, Boeing changed the name of the company to Boeing Airplane Company and set up manufacturing operations at the Heath Shipyard, transforming the shipbuilding facility into an aircraft manufacturing plant. The Boeing Airplane Company’s success as a military contractor during World War I and the location of its manufacturing facility at the former Heath Shipyard on the Duwamish River grounded the company in the Northwest and set the stage for its growth in the interwar years.

The environment of the Pacific Northwest played an important role in the early years of aviation and contributed to the success of William Boeing’s eponymous aircraft company. From the Wright Brothers’ first successful flight in 1903 through the 1930s, wood was the primary building material for constructing aircraft. Many of the species best suited for airframe construction grew in the Northwest. Engineers prized Sitka spruce, which grew only in the Pacific Northwest, as “the wood par excellence for the construction of aircraft” due to its light weight, high strength to weight ratio, and ease of use. Red and white spruce, which grew in New England, the northern lake states, and across Canada, offered similar properties to Sitka spruce. But Sitka spruce grew larger and therefore produced more clear grain lumber suitable for aircraft parts. Douglas-fir served as “a very satisfactory substitute for spruce,” although it was heavier than Sitka spruce. Douglas-fir grew throughout the West, but only the trees from the Pacific

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10 Bowers, Boeing Aircraft since 1916, 33-35.

Northwest had the specific qualities, including a slightly lower density, suitable for use in aircraft.\(^2\) The availability of top-quality aviation-grade lumber locally gave Boeing an environmental advantage over other early airframe manufacturers. In addition, the profusion of lumber mills and manufacturers of wood products, like ships and furniture, in Seattle provided Boeing with a pool of skilled craftspeople who could put their woodworking experience to work in the burgeoning aircraft industry.\(^3\)

Not only was Seattle situated near sources of high-quality aviation-grade timber, its location also offered easy access to large, calm bodies of water that could accommodate take-offs and landings for seaplanes. In the first decades of powered flight, many airplane manufacturers, including William Boeing, constructed seaplanes and flying boats to utilize rivers, lakes, and oceans as runways. Seaplanes enabled aviation to expand to places where airfields did not yet exist. Water-based aircraft also offered aviators the advantage of being able to take off or land from any direction, making it easier to face directly into the wind to achieve safe flight. Lake Union and Lake Washington provided ideal bases of operation for early aviation in the Seattle area. The lakes were relatively calm, did not ice over in the winter, and were easily accessible from the city center.\(^4\) While Eastern and Midwestern cities offered early aircraft manufacturers the benefits of industrial infrastructure and a skilled manufacturing workforce, the

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environment of the Pacific Northwest proved a favorable setting in which an aircraft industry could develop.

Two major changes to land use patterns in Seattle in the 1910s and 1920s helped to create a new landscape on the south side of the city conducive to the growth of industry in general and aviation in particular. The dredging of the Duwamish River and the construction of King County Airport by King County and the state of Washington transformed the Duwamish Valley from a marshy flatland dotted with farms into a booming industrial center. These two projects represent the successful collaboration between local boosters and government agencies intent on attracting industry to the region. By reshaping the Duwamish River and constructing a municipal airfield, Seattle provided the physical prerequisites for Boeing’s growth during World War II.

When William Boeing moved to Seattle in 1908 and started the Greenwood Timber Company, he encountered a city in the throes of construction. Between 1898 and 1930, the City of Seattle and Army Corps of Engineers undertook several major public works projects that completely transformed the city’s landscape. Progressive-era planners and engineers embraced the notion of conservation and sought to remake the urban environment to provide a city that would be more economically, physically, and morally healthful for its residents. The first and longest-running of these projects was the regrading of Seattle’s topography, flattening the steepest hills and using the excavated dirt to fill in the waterfront and create Harbor Island in


Elliott Bay.\textsuperscript{17} Second was the construction of the Lake Washington Ship Canal. Completed by the Army Corps of Engineers in 1916 and funded by King County, the state of Washington, and the federal government, the canal connected Lake Washington with Lake Union and Puget Sound, opening a new transportation route for the region’s raw materials into and out of Seattle’s processing plants.\textsuperscript{18} These two projects revolutionized the landscape of the city and facilitated transportation between the city and its hinterlands. The Lake Washington Ship Canal proved a boon to sawmills and other materials processing industries around Lake Union, improving networks between sites of extraction to the east of Seattle and sites of production and distribution in the city. Boosters hoped that the canal would increase industrial land use around Lake Union and Lake Washington. However, economic and environmental considerations drew planners and business owners to the south side of Seattle.

The landscape south of downtown Seattle seemed an ideal location for industry. In contrast to much of the city, the Duwamish Valley was relatively flat and open. The Duwamish River, which originated in the foothills of the Cascade Mountains as the Green River, meandered on a winding course from Tukwila north through the valley between the south end of Lake Washington and Puget Sound and emptied into Elliott Bay. The natural resources of the Duwamish Valley provided a means of subsistence for the area’s diverse residents, including the indigenous Duwamish people who fished for salmon in the river, and farmers, many of whom were recent immigrants from Italy and Japan, who took advantage of the valley’s fertile soil and

\textsuperscript{17} David Wilma, “Harbor Island, at the time the world's largest artificial island, is completed in 1909,” HistoryLink.org Online Encyclopedia of Washington State History, November 6, 2001, https://www.historylink.org/file/3631

established successful truck farms. In addition to the advantageous topography, the valley was proximal to several modes of transportation. The mouth of the Duwamish River opened right into Elliott Bay, near existing industrial and shipping facilities on Seattle’s waterfront. The Great Northern Railway, Northern Pacific Railway, and several other smaller lines had tracks running through the valley. Finally, land values were relatively inexpensive compared to industrial sites around Lake Union or downtown waterfront property, especially since the valley lay outside the city limits and was thus not subject to Seattle’s taxes. With these advantages in their sights, and despite the local residents’ land use patterns, city planners and business owners at the turn of the century set out to remake the Duwamish Valley into Seattle’s premier industrial center.

Like Seattle’s hills, the Duwamish River had to be tamed by engineers in order to create a rational space for industry. The Duwamish Valley was low-lying and prone to flooding, not only from the Duwamish River and the nearby Green, White, and Black Rivers, but from brackish water that made its way inland at high tides. The channel of the Duwamish River was relatively shallow and followed a circuitous route to Puget Sound, emptying into Elliott Bay and creating a marshy estuary. The process of transforming the river began in 1895 when the Seattle and Lake Washington Waterway Company, headed by former territorial governor Eugene Semple, started to dredge out channels in the estuary at the mouth of the Duwamish. Part of a larger project to construct a channel from Lake Washington to the Duwamish through Beacon Hill and Georgetown, the improvement of the lower portion of the Duwamish sought to straighten and


deepen the river’s channel and to provide additional waterfront space on Elliott Bay. Semple’s project quickly became mired in court battles and mud and was abandoned in 1904.  

But Seattle boosters did not abandon the vision of a reclaimed Duwamish River. In 1909, the state legislature created the Duwamish Improvement District, and the next year voters approved a bond to fund work on the river. The Duwamish Improvement District hoped to get the Army Corps of Engineers to complete the work, however they declined, stating that such a project would “place the United States in the position of improving a river to create a traffic instead of to accommodate a commerce already existing.” Instead, King County and the state of Washington provided the funds for the project. Between 1911 and 1924, crews worked to straighten the Duwamish River and deepen its channel. The construction of the Duwamish Waterway and completion of the Lake Washington Ship Canal, which lowered the level of Lake Washington by seven feet, created a new landscape in the Duwamish Valley, eliminating much of the danger of flooding and replacing a meandering river with a waterway designed for work.

While the Duwamish Waterway was under construction, boosters worked to attract industry to the area and continued to lobby the federal government for funding to improve the waterway. Many improvement associations were established in the Georgetown and South Park

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22 Willingham, 80; Berner, *Seattle 1900-1920*, 17-19. Semple’s plan interfered with the Army Corps of Engineers’ plan to connect Lake Washington with Puget Sound via Lake Union and Salmon Bay, a plan backed by the city’s elites and the railroads. Thomas Burke, a city booster, north side landowner, and attorney for the Great Northern Railway, challenged Semple in court several times to put a stop to his project. In addition to the political impediments, the environment also proved a formidable obstacle to Semple. His plan called for the digging of a canal through Beacon Hill, sluicing away the hillside with high pressure water. Workers not only encountered massive boulders that resisted their efforts, but also increasing the muck in the nearby waterways that would need to be dredged out, adding to the expense and duration of the project.


neighborhoods to the east and west, respectively, of the Duwamish Waterway. Groups like the Duwamish River Commercial Club and the Industrial Association of the South End lobbied the county to plat parcels and offer land for sale, to pave roads and extend streetcar service from Seattle, and to further improvements the waterway.\textsuperscript{26} The Boeing Airplane Company became one of the early manufacturing concerns to locate in the emerging Duwamish industrial corridor when the company moved into the Heath Shipyard facility along the Duwamish Waterway in 1917. The company took an active interest in the development of the area. Boeing executives, including Presidents Edgar N. Gott and Philip G. Johnson, served as members and officers of local improvement organizations in the 1920s and 1930s.\textsuperscript{27} Along with its growing number of industrial neighbors, Boeing pushed for continued development of the Duwamish Valley, playing an active role in the transformation of the valley from farmland into Seattle’s manufacturing hub.

By the mid-1920s, Boeing had weathered a postwar economic slump and was successfully producing aircraft for military and commercial uses. However, its physical footprint on the city remained relatively small. By 1928, the company’s facilities at the north end of the Duwamish consisted of the original Heath Shipyard building, a larger assembly building, an office building, and several smaller sheds and outbuildings.\textsuperscript{28} While these structures provided sufficient space for Boeing to meet its production needs, notably absent from the city’s landscape

\textsuperscript{26} For examples of these associations’ activities, see the \textit{Seattle Times} articles: “New Improvement Club,” August 24, 1911; “Officials Unite to Get Industries,” October 7, 1919; and “To Urge Duwamish Aid,” December 31, 1922.

\textsuperscript{27} Edgar Gott, Boeing President from 1922 to 1925, served as an officer of the Industrial Association of the South End, and Philip Johnson, Boeing President from 1926 to 1933, was a member of the Consolidated South District Commercial Club. \textit{Seattle Times}, January 28, 1920; “Industrial District Will Be Developed,” September 22, 1926.

was a municipal airport. Although pilots flying seaplanes had plenty of options for take-offs and landings, pilots of land-based aircraft were forced to make do with The Meadows racetrack, municipal golf courses, or any open field available. In 1919, King County commissioners set out to locate a suitable site for an airport. The group selected a 220-acre site at Sand Point northeast of Seattle’s city center along the shore of Lake Washington. A small airfield was constructed, and the property turned over to the Navy in 1923 to be used jointly for Army, Navy, and private flight operations. While this location served the Navy well, it quickly outgrew its utility as a multi-use airport.

By 1926, city engineers began conducting surveys to determine a location for a new commercial airport. The need for an airport was particularly acute for Boeing. After the largest components of the aircraft were completed at the plant on the Duwamish, Boeing aircraft had to be barged to Lake Union, Sand Point, or Camp Lewis in Tacoma and assembled for flight testing, then disassembled, crated, and shipped to customers by railroad. In the mid-1920s, Boeing’s production increased to meet demands for commercial aircraft for the burgeoning air mail service, as well as for aircraft for the Army and Navy, making this delivery process time-consuming and costly. The present and presumed future economic benefits of Boeing for the city propelled county commissioners to situate the new municipal airport in the Duwamish Valley. The same environmental and transportation advantages that the valley presented to industry held true for the airport as well: land was inexpensive, flat, and serviced by railroad lines. Construction began in 1927 on a 425-acre site in Georgetown, just to the east of the

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Duwamish Waterway. Thousands of people turned out for the dedication of the airport on July 26, 1928. King county commissioners chose to name the airport Boeing Field in recognition of the contributions of William Boeing to the aviation industry and the city of Seattle. At the dedication ceremony, William Boeing declared that “this day is just about the happiest one of my life. Of all the honors that could have been given me, none could give me a greater feeling of real contentment.” Boeing Field served as an anchor for the Boeing Airplane Company, securing the company in the Duwamish Valley. The creation of the Duwamish Waterway by King County and the state, the subsequent expansion of the waterway by the Army Corps of Engineers, and the construction of Boeing Field by King county signaled the start of the public-private partnership between Boeing, local governments, and the federal government. This relationship would prove transformative for Boeing and Seattle during World War II.

**The Interwar Years**

The Interwar years marked the rapid development of aviation. During the 1920s and 1930s, aircraft design shifted from open-cockpit, wooden, fabric-covered biplanes to sleek, all-metal, multi-engine monoplanes capable of carrying passengers and crossing oceans. In the wake of postwar disarmament, airframe manufacturers like Boeing turned to the market for aircraft generated by the burgeoning commercial aviation industry. The Air Mail Act of 1925 helped to spur the growth of airlines and create a market for aircraft. The Act allowed the Post Office to offer contracts to private companies to deliver air mail over specific routes across the

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country. Boeing won the contract for the route between Seattle and Los Angeles and established Boeing Air Transport as the airline subsidiary of Boeing Airplane Company. Throughout the 1920s, the aviation industry sought to vertically integrate and by the 1930s, consisted of only a few large conglomerate companies, including Boeing, that controlled airframe manufacturers, propeller manufacturers, engine manufacturers, and airlines. But in 1934, the Roosevelt administration passed legislation to break up the monopolies and prohibited airframe and engine manufacturers from owning or operating airlines. The Boeing Airplane Company survived as an airframe manufacturer, but founder William Boeing retired and the company struggled financially, reducing its labor force from around 1,700 to 700. The war emerged at both a challenging and opportune time for Boeing. The potential to obtain military contracts on the eve of World War II offered Boeing the chance to rebuild from the losses from its reorganization and the Great Depression.

The development of air warfare doctrine in the Interwar years shaped the market for military aircraft. Since its beginnings as the Army Air Service in 1918, the Army Air Corps (AAC) served an auxiliary role within the US Army, primarily tasked with providing support to ground troops. Although Allied pilots proved the effectiveness of aerial warfare in its own right

33 Serling, Legend and Legacy, 10, 16-17. For more on the role of air mail in the development of the commercial airline industry, please see F. Robert van der Linden, Airlines and Air Mail: The Post Office and the Birth of the Commercial Aviation Industry (Lexington: University Press of Kentucky, 2014).

34 Boeing had become United Aircraft and Transport Corporation, but in 1934 was split into United Airlines Transport, United Aircraft Manufacturing Company (which included engine maker Pratt & Whitney), and Boeing Airplane Company. Serling, Legend and Legacy, 25-26, van der Linden, Airlines and Air Mail, 289.


36 The US Army Air Service was the first independent branch responsible for aerial warfare within the US Army. In 1926 the USAAS was renamed the Army Air Corps in 1926. In 1941, the AAC was reorganized as the US Army Air Forces and given more autonomy in 1942. The United States Air Force became an independent service in 1947.
during World War I, Army and Navy doctrine still considered aircraft a subordinate to infantry, artillery, or the striking power of large capital ships. Not all officers shared this view, however. World War I aviator and Assistant Chief of the Air Service General William “Billy” Mitchell became an outspoken proponent of the use of aerial bombardment in warfare. To convince the Army and Navy leaders of the value of air power, he staged a series of demonstrations in 1921 and 1923 in which Army, Navy, and Marine pilots sunk a captured German battleship and three American battleships slated for destruction.\(^{37}\) Despite these compelling demonstrations of the possibilities of air power, it took another decade for Air Corps tacticians to fully develop the concept of strategic bombardment and for the doctrine to be accepted by military leadership.\(^{38}\)

The doctrine of strategic bombing called for the Air Corps to “attack the whole of the ‘enemy national structure,’” with particular attention to the enemy nation’s “economic structure” and “‘industrial web.’”\(^{39}\) To accomplish this goal, the Air Corps would need either access to bases on Allied lands closer to enemy territory or aircraft with a longer range and a greater bomb-carrying capacity. Unlike the Navy, which operated its own shipyards to construct and repair its fleet, the Army Air Corps relied primarily upon civilian airframe manufacturers to design and build military aircraft. Although the Air Corps did not produce its own aircraft, engineers with the Air Corps Materiel Command and National Advisory Committee for Aeronautics worked closely with airframe manufacturers in research and development. The


\(^{39}\) Craven and Cate, *Plans and Early Operations*, 51-52.
development of larger, multi-engine passenger aircraft to meet the needs of the growing commercial aviation industry gave airframe manufacturers the knowledge and experience to design new heavy bomber aircraft for the Air Corps.\(^{40}\)

**B-17 Flying Fortress**

![B-17 Flying Fortress](image)

Figure 15. Seattle-built B-17E, c. 1942. USAF image 080306-F-3927A-054.

In 1934, the Army Air Corps released a proposal for the development of a long-range multi-engine bomber, with a range of up to 2,200 miles, a cruising speed 250 miles per hour, and the capability of carrying a payload of two thousand pounds.\(^{41}\) Eager to secure a government contract, Boeing developed Model 299 at its own expense in response to the proposal. The Model 299 was a four-engine, all-metal monoplane. The aircraft had a range of 3,100 miles and a cruising speed of 140 miles per hour. Nearly sixty-nine feet long and with a wingspan of more than one hundred feet, the massive aircraft bristled with five machine guns. When the Model 299


rolled out of Boeing’s assembly plant to a crowd of press and spectators for its first flight on July 28, 1935, one of the reporters allegedly exclaimed “‘she’s a flying fortress!’” thus giving what would become the B-17 its famous nickname.\textsuperscript{42}

After its first flight, Model 299 flew to the AAC Air Materiel Command headquarters at Wright Field in Dayton, Ohio for testing and comparison with other manufacturers’ aircraft. The AAC was impressed by the Model 299 and sought to order sixty-five of the aircraft from Boeing. However, during a test flight in October 1935, the Model 299 crashed, killing two of the four men aboard. Although the crash was due to pilot error (failure to release the plane’s elevator and rudder lock), the AAC General Staff reduced the initial order to thirteen aircraft, to be delivered in 1937.\textsuperscript{43}

Boeing built the thirteen bombers, designated by the AAC as B-17, at its facility along the Duwamish Waterway that had grown from the Heath Shipyards buildings. However, the facilities proved inadequate for production of such a large aircraft. Boeing sought to expand its facilities to meet the needs of its growing business. Boeing executives considered relocating to Southern California to take advantage of the region’s weather and pool of experienced aircraft workers. Seattleites criticized Boeing’s potential move and offered various inducements to convince the company to stay. One such inducement came from Joe Desimone, a wealthy truck farmer with lands in the Duwamish Valley who would eventually go on to own Pike Place Market. Concerned that Boeing would leave Seattle, Desimone sold the company several acres of land for $1 in 1936. Boeing acquired a total of twenty-eight acres from Desimone, Frye &

\textsuperscript{42} As quoted in Serling, Legend and Legacy, 31; Bowers, Boeing Aircraft Since 1916, 291-292; Craven and Cate, Men and Planes, 203; “B-17 Production and Construction Analysis,” 9, Boeing Archives.


Construction on what became known as Plant Two began in 1936. Its location, a few miles south of Boeing’s original Plant One, offered easy access to railroad lines, to receive parts and materials, and Boeing Field, to deliver completed aircraft. Plant Two was completed just in time to accommodate an additional order of thirty-nine B-17s in 1937. In response to President Roosevelt’s call for a 50,000 aircraft production program in May 1940, Boeing needed to expand its production facilities again to fulfill the AAC’s influx of orders for thousands of new B-17s. The federal government funded the expansion of Plant Two in 1940, with the AAC providing $7 million for improvements.\footnote{William Glenn Cunningham, The Aircraft Industry: A Study in Industrial Location (Los Angeles: Lorin L. Morrison, 1951), 76; Craven and Cate, Men and Planes, 204; “Case History of The Boeing Aircraft Company, Seattle Washington;” Box 31; Office, Assistant Chief of Air Staff, Materiel and Services (A-4), R & D Branch, Case Histories, 1941-1946; Entry 22; Record Group 18, Records of the Army Air Forces (RG 18); National Archives at College Park, College Park, MD (NACP).} Over the course of the war, each subsequent order for aircraft from Boeing required the expansion of the company’s physical plant. Plant Two became a sprawling campus complete with a main assembly building, engineering building, paint and camouflage buildings, warehouses, and an aerodynamics lab with a wind tunnel. Over the course of the war, the federal government spent more than $15 million on improvements and equipment for Plant Two, and an additional $8.8 million to upgrade Boeing Field, from which the AAF took delivery of completed B-17s.\footnote{“Case History of Boeing Aircraft Company, Seattle, Washington,” RG 18, NACP, 10-11; Boeing Aircraft Company, Master Manual Plant 2, Boeing Aircraft Company (April 1943), Boeing Archives.}
In order to build the thousands of B-17s needed for the Army Air Corps, Boeing developed mass-production techniques using subcontractors and feeder plants to produce parts for final assembly in Plant Two. Boeing subcontracted the production of thousands of parts, equipment, and subassemblies to firms in the Northwest and across the country. Indeed, industry experts estimated that “it takes 248 factories to make a Flying Fortress.” For example, Briggs Manufacturing Company in Detroit made the bomb bay doors, tank doors, and flaps. Kawneer in Michigan, an established aluminum manufacturing company, produced the aluminum alloy fuselage circumferentials (rings) for the plane’s fuselage. Stearman Aircraft in Wichita, a subsidiary of Boeing, manufactured the outboard wings, wing tips, ailerons, elevators, and rudders. Northrup Aircraft Company in California made the engine nacelles, the housing for the

aircraft engines. Vega Airplane Company in Burbank, California made the ring cowls, which cover the front of the radial engines, making them more aerodynamic. Solar Aircraft Company in California made the exhaust stacks, pipes which ran between the engine exhaust and the supercharger. Studebaker produced the majority of the Wright R-1820 Cyclone engines at its plant in South Bend, Indiana. Finally, Pacific Car and Foundry Company in Renton, Washington assembled the inboard spars for the wings.48

Boeing also developed a “feeder plant” system, in which auxiliary plants throughout the Northwest, operated by Boeing, built larger subassemblies of the B-17s and transported them to Plant Two for final assembly. The use of feeder plants would enable Boeing to take advantage of available manpower outside of the Seattle area and to prevent exacerbating the housing and transportation problems facing the city during the war. Boeing established feeder plants in Aberdeen, Everett, Bellingham, Chehalis, and Tacoma, Washington. Components produced in the feeder plants included gun emplacements, door frames, bomb racks, pilot and copilot seats, struts, pilot and engineer stations, and wheel well assemblies.49

Boeing used local materials in the construction of B-17s. As aluminum became a more scarce and was needed for critical uses in aircraft construction, other materials were substituted for components where practical. Beginning in 1941 with the B-17Es, Douglas-fir plywood flooring replaced aluminum flooring. Wood was also used for the radio operator’s and navigator’s tables, bulkhead doors, bombsight box, and instrument panel housing. Plywood was also used extensively in the manufacturing process. Workers used wood to create jigs for assembling component parts, like wings. Workers also used plywood for templates for cutting

49 “B-17 Production and Construction Analysis,” 32-34, exhibit 17, exhibit 20, Boeing Archives.
aluminum sheet and for wiring.\textsuperscript{50} The use of wood was advantageous for Boeing in particular because of the proximity to an abundant supply of wood in the Pacific Northwest. Boeing had a long list of local suppliers from whom the company could acquire the necessary wood on 24 hours’ notice.\textsuperscript{51}

Figure 17. Boeing workers in Seattle crafting wiring assemblies for B-17s using a plywood template, December 1942. Photo by Andreas Feininger. LC-USE6- D-008360, Farm Security Administration/Office Of War Information Photograph Collection, Prints and Photographs Division, Library of Congress.

Between January 1940 and August 31, 1945, the Army Air Force accepted 12,692 B-17s, 6,981 of which were built in Seattle.\textsuperscript{52} B-17s deployed in every theater of war across the globe.

\textsuperscript{50} H. Oliver West, “Multiline Production Speeds Flying Fortress Deliveries,” Boeing Press Release, November 6, 1942, Boeing Archives.


\textsuperscript{52} Craven and Cate, \textit{Men and Planes}, 206; Bowers, \textit{Boeing Aircraft Since 1916}, 286.
Upon receipt by the Army Air Force at Boeing Field, Air Transport Command pilots, some of whom were Women Airforce Service Pilots, flew the aircraft to modification centers to be equipped for deployment to specific theaters of war.\textsuperscript{53} From there, the aircraft joined their bomb groups and flew overseas. B-17s became the backbone of the Army Air Force’s strategic bombing campaign in Europe. Heavy bombers, including B-17s and B-24s, completed 274,941 sorties in the European Theater of Operations and 147,111 in the Mediterranean between 1942 and 1945. American aircraft, including B-17s, dropped a total of 1,554,463 tons of bombs against enemy targets in Europe and the Mediterranean. Heavy bombers also completed more than 77,000 in the Pacific Theater.\textsuperscript{54}

\textbf{B-29 Superfortress}

Figure 18. B-29 with Mt. Rainier in the background, Washington, c. 1942-1945. National Automotive History Collection, Detroit Public Library, Resource ID na032504.


\textsuperscript{54} Office of Statistical Control, \textit{Army Air Forces Statistical Digest World War II} (December 1945), 222-225, 239.
The B-29 had its origins in efforts to improve upon the B-17 and expand its mission. In May 1939, General Hap Arnold, Chief of the Army Air Corps, convened a board of officers and aviation experts to propose a plan for the research and development of military aircraft over the next five years. One of the types of aircraft proposed was a long-range bomber that was faster and could carry more bombs further than the B-17.\textsuperscript{55} A worst-case scenario, where Germany conquered all of Europe, including Great Britain, Africa, and even South America, would remove the possibility of the Air Corps operating from forward bases and require very long-range aircraft to protect the US and strike enemy territory.\textsuperscript{56} In January 1940, the AAC released specifications to airframe manufacturers for a “really big bomber,” with a range of 5,333 miles, speed of 400 miles per hour, and ability to carry 2,000 pounds of bombs.\textsuperscript{57} Boeing, Lockheed Aircraft Company, Douglas Aircraft Company, and Consolidated Aircraft all submitted proposals for aircraft, and in September 1940, Boeing and Consolidated received contracts for their designs.\textsuperscript{58}

Boeing designed its aircraft, ultimately designated the B-29, based on the knowledge it gained from developing the B-17, the XB-15, and Stratoliner, as well as from feedback from the Air Corps on the performance of B-17s in combat.\textsuperscript{59} The B-29 was larger than the B-17, with a wingspan of 141 feet, length of 99 feet, top speed of 365 miles per hour, and a range of 5,830

\textsuperscript{55} Craven and Cate, \textit{Men and Planes}, 178-179.

\textsuperscript{56} Jacob A. Vander Meulen, \textit{Building the B-29} (Washington: Smithsonian Institution Press, 1995), 14.

\textsuperscript{57} Craven and Cate, \textit{Men and Planes}, 208; Bowers, \textit{Boeing Aircraft Since 1916}, 318-319.

\textsuperscript{58} Consolidated’s aircraft, the B-32, took longer to develop and did not prove successful. Only 118 of the aircraft were built and only fifteen of those were flew in combat. Craven and Cate, \textit{Men and Planes}, 210.

\textsuperscript{59} The XB-15 was an experimental heavy bomber designed just before the B-17. The Stratoliner was designed in the late 1930s as a commercial airliner with a pressurized cabin. Vander Meulen, \textit{Building the B-29}, 15; Bowers \textit{Boeing Aircraft Since 1916}, 228-231.
miles. Like the B-17, the B-29 was all metal except for fabric-covered control surfaces. The aircraft was powered by four Wright R-3350 Cyclone engines and could carry up to 8,000 pounds of bombs. Ten to twelve .50 caliber machine guns and one 20-millimeter cannon provided defense against enemy aircraft. The B-29 was the first production military aircraft to feature a pressurized cabin for the aircrew. The aircraft made its first flight on September 21, 1942, and Boeing delivered the first B-29s to the AAF in July 1943.\(^{60}\)

As Boeing explained after the war, “the B-29 was the largest and most complicated of any airplane manufactured on a mass production basis, during World War II.”\(^{61}\) Even before the aircraft’s first flight, the Army Air Force ordered 250 B-29s in May 1941, to be constructed at Boeing’s new plant in Wichita. In January 1942, the AAF doubled the order to five hundred planes, necessitating the expansion of B-29 production facilities. Ultimately, four different facilities throughout the country would assemble B-29s: Boeing’s Wichita plant, the Glenn L. Martin Company plant in Omaha, and Bell Aircraft’s new plant in Marietta, Georgia\(^{62}\), and a new aircraft production facility in Renton, Washington.

What eventually became Boeing’s Renton plant was built by the Navy to construct PBB-1 Sea Ranger long-range patrol bombers. The Navy ordered fifty-seven of these aircraft from Boeing and in 1940 began construction on a new manufacturing facility for the aircraft. The ninety-five-acre site was situated on marshland at the south tip of Lake Washington, providing easy access for the seaplanes from the main factory building to the waterfront. The Navy paid

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\(^{60}\) Bowers, *Boeing Aircraft Since 1916*, 322, 326; Craven and Cate, *Men and Planes*, 209


\(^{62}\) “B-29 Production and Construction Analysis,” ii-iv, Boeing Archives.
more than $19 million for construction, but ultimately canceled its order for the Sea Rangers, as the Navy’s PBY Catalina medium-range patrol bomber proved sufficient for its needs, leaving the Renton plant without a tenant. At the same time, the Navy ordered more North American B-25 medium bombers, to be built at North American’s factory in Kansas City. The AAF had intended to convert the Kansas City to B-29 production, as its own demand for B-25s had waned. Instead, in 1942, the AAF and Navy reached an agreement for B-25 production to continue in Kansas City while the Navy would transfer its lease of the Renton plant to the AAF for the production of B-29s. Since the Renton plant was built for seaplanes, it had no runway. In order to accommodate the B-29s, the AAF spent an additional $2 million between 1942 and 1943 to add a runway, taxiways, aprons, various operations buildings, and even a bridge over the Cedar River between the factory and airstrip.63

Figure 19. Boeing Renton plant at the south end of Lake Washington, Renton, Washington, c. 1945. Record Group 18, National Archives at College Park, MD.

63 Sellars, Legend and Legacy, 61; Bowers, Boeing Aircraft Since 1916, 248-249; “Case History of The Boeing Aircraft Company, Renton Washington;” Box 32; Office, Assistant Chief of Air Staff, Materiel and Services (A-4), R & D Branch, Case Histories, 1941-1946; Entry 22; Record Group 18, NACP; “B-29 Production and Construction Analysis,” ii-iv, 14-15, Boeing Archives.
Boeing applied what it had learned in developing mass-production techniques for the B-17 to speed production of B-29s in Renton and across the country. Renton served as the final assembly plant for numerous feeder plants in the Northwest and contractors across the country. Boeing’s feeder plants throughout the Northwest, including in Hoquiam, Aberdeen, Chehalis, Bellingham, Everett, and Tacoma, Washington, and Vancouver, British Columbia retooled from B-17 to B-29 production Eventually as the need for B-17s waned in 1944, Boeing converted Plant Two from B-17 production to a feeder plant for Renton. These feeder plants produced major subassemblies, such as the nose section, two large fuselage sections, wing spars, and the bomb bay area and its mechanisms. A few subcontractors were located in the Northwest, but the majority were located in the Midwest. For example, Kenworth, maker of logging trucks, built the B-29’s nose wheel well and pilot’s floor at its Seattle factory. Jensvold Manufacturing Company in Olympia, Washington, manufactured the tunnels that connected the forward and rear pressurized crew compartments. Briggs Manufacturing in Detroit constructed the majority of the aircraft’s control surfaces, including the horizontal and vertical stabilizer, elevators, and rudder. Chrysler manufactured the Wright Duplex-Cyclone engines at its massive plant in Chicago. Parts and assemblies traveled by truck and train to Renton, taking between twelve and twenty days to arrive from the Midwest. At the Renton plant, the parts and subassemblies followed an assembly line process as workers assembled the aircraft. At its peak in February 1944, Plant Two and Renton employed 21,619 people working on B-29s. By the end of August 1945, 3,763 B-29s had been delivered to the AAF, 1,119 of which were built in Renton.

Military planners originally intended the B-29 to carry out strategic bombing campaigns in Europe and the Pacific. However, production delays postponed the deployment of B-29s in Europe, making it difficult for Eight Air Force leaders in England to plan for the expansion of bases necessary to accommodate the larger aircraft and to incorporate them into war plans. General Eaker, commander of the Eight Air Force, elected to continue to use only B-17s and B-24s in the strategic bombing campaign against Germany. Instead, the B-29s became an essential element in the late stages of the Allied war against Japan. In early 1944, the first B-29s of the Twentieth Bomber Command arrived in India and China, flying from the United States east over the Atlantic and via North Africa to confuse Axis observers. On June 5, 1944, B-29s performed their first combat mission, taking off from India to bomb Bangkok. The Twentieth Air Force struck Japan’s mainland for the first time on June 15th. After the successful capture of the Mariana Islands in the western Pacific by the Navy’s island hopping campaign, the Twentieth Air Force relocated there for easier access to Japan. Between 1944 and 1945, the B-29s of the Twentieth Air Force flew 29,153 sorties, dropping 169,676 tons of bombs on enemy targets. The bombs dropped by B-29s inflicted massive destruction on Japan. Between November 1944 and August 1945, B-29s destroyed more than 178 square miles of urban areas in Japan. Two B-29s


were modified to carry the atomic bombs dropped on Hiroshima on August 6, 1945, and Nagasaki on August 9, 1945, signaling the end of the war with Japan.\textsuperscript{69}

**Conclusion**

Over the course of the war, Boeing built 6,981 B-17s and 1,119 B-29s at its Seattle-area plants, transforming Seattle into Fortress City.\textsuperscript{70} While these bombers rained destruction overseas, their production in Seattle brought prosperity to the region. At the peak of production in 1944, Boeing employed more than fifty thousand people in the Seattle area. The federal government spent more than $40 million to enlarge the existing facilities of Boeing’s Plant Two and Boeing Field, and to construct an entirely new manufacturing plant in Renton for the production of B-29s.\textsuperscript{71} These massive facilities and the tools within were not mere temporary structures but were built to last. Plant Two, Boeing Field, and the Renton plant became the basis for Boeing’s postwar success as a military contractor and builder of commercial airliners.

Boeing leveraged its wartime knowledge, experience, and property to become one of the leading producers of commercial and military aircraft in the country, transforming Seattle from “Fortress City” into “Jet City” in the postwar era. Although aircraft manufacturing declined significantly in the immediate postwar era, rearmament for the Korean War and the growth of commercial aviation in the 1950s enabled Boeing to resume large-scale production. After the federal government declared the Renton plant as surplus in 1946, Boeing purchased the plant

\textsuperscript{69} The B-29 *Enola Gay* dropped the first atomic bomb on Hiroshima, and the *Bockscar* dropped the atomic bomb, made from plutonium produced in Hanford, on Nagasaki. For more on those aircraft, please see Richard H. Campbell, *The Silverplate Bombers: A History and Registry of the Enola Gay and Other B-29s Configured to Carry Atomic Bombs* (Jefferson, NC: McFarland & Company, Inc, 2005). For more on the horrors unleashed by these bombs, please refer to footnote 147 in chapter one.

\textsuperscript{70} Bowers, *Boeing Aircraft Since 1916*, 286, 328.

from the government in 1962 for $8.5 million, less than half of what it cost the government to construct.\(^{72}\) With the development of the 707 jetliner in 1958, the nation’s first commercially successful jetliner, engineered and built at the Renton plant, Boeing became the premier manufacturer of jetliners in the United States.\(^{73}\) Boeing’s greatest success as a producer of commercial jets came with the development of the 737. Engineers designed and built the first 737s in Plant Two and the plane took its first flight from Boeing Field in 1967. The 737 has become the most successful and most-produced commercial jetliner in aviation history and is the backbone of Boeing’s commercial airline division. It is now produced exclusively at the Renton Plant.\(^{74}\) As late as 2015, Boeing was the top private employer in Washington state, but by 2022 had fallen behind Amazon and Microsoft. Boeing still employs more than 60,000 people in its facilities in the Puget Sound region and throughout the state.\(^{75}\) Although Boeing’s facilities have expanded and changed since the war, and Plant Two has been demolished, nonetheless the physical and economic infrastructure created for World War II remains a significant component of the region’s landscape, economy, and identity today.

\(^{72}\) “GSA News Release, Friday, August 31, 1962,” Box 38; Real Property Disposition Case Files, 1959-1966; Record Group 291, Records of the General Services Administration (RG 291); National Archives at Seattle.


CONCLUSION

War is a powerful agent of change. Its unpredictable effects reach far beyond the battlefields, both spatially and temporally. While weapons of war wrought destruction abroad during World War II, the production of those weapons generated prosperity in the United States. In planning for how to win the war, the government also envisioned a path to “win the peace.” Indeed, President Roosevelt directed the National Resource Planning Board to study “post-defense planning” in 1940, before the US even entered the war.1 In the 1942 pamphlet, “Better Cities,” the NRPB explained that the nation’s first priority is to win the war, but “to sustain us in this task it is important that we begin to shape a picture of the kind of world in which we hope to live after victory, to spur us on and to redeem this prodigious effort.”2 The federal government sought to harness the economic power of the war to further New Deal goals and to prevent another postwar economic crisis like the nation experienced after the First World War.

The Pacific Northwest offered planners myriad resources to employ for the war effort and spur economic development. Throughout the 1930s, planners studied ways to direct the efforts of the New Deal to support two major goals for the Northwest: to rationalize the use of the region’s resources and to diversify the region’s economy. To achieve these goals, the federal government promoted conservation policies to stabilize Northwest forests and encourage longevity of the

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logging industry, built Bonneville and Grand Coulee Dams to provide electricity and irrigation water, and encouraged the development of new manufacturing industries that would utilize local raw materials. These efforts set the foundation for the Northwest’s contribution to the war effort.

But war is not a rational agent of change. War mobilization forced planners, the military, and industry to reimagine how to use Northwest resources to meet the ever-changing demands of war. This resulted in a region that looked very different in 1945 than it did in 1939. The wartime development of Northwest water and timber resources and the growth of shipbuilding and aircraft manufacturing reshaped the physical and economic landscape of the Pacific Northwest. This led to more intensive use of the region’s natural resources, diversification of the region’s economy, and closer ties to the federal government.

Building America’s Arsenal of Democracy produced lasting changes to the Pacific Northwest’s environment. The construction of Bonneville and Grand Coulee Dams represented the beginning of the transformation of the Columbia River from a free-flowing river into what historian Richard White terms an “organic machine.” The Army Corps of Engineers and the Bureau of Reclamation put the river to work, arresting its flow to harness its power for industry. The success of Bonneville and Grand Coulee in providing low-cost electricity and attracting industry to the region set the precedent for a spree of dam construction in the postwar era. Eight additional dams were built on the main stem of the Columbia River after the war, including The Dalles Dam, completed in 1957, which inundated Celilo Falls. The profusion of dams has slowed the flow and raised the temperature of the river, decimating anadromous fish populations.

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The industries powered by the Columbia River turned the region’s cities, forests, and deserts into sites of war. Shipyards in Seattle, Tacoma, Vancouver, and Portland sprawled along the cities’ waterfronts taking advantage of one of the key resources required by shipbuilding: land. Boeing, with its Seattle and Renton assembly plants, feeder plants, subcontractors, and materials suppliers located throughout the Northwest also contributed to changing land use patterns and industrialization. The construction of Hanford Engineer Works represented the most improbable and extraordinary example of wartime environmental transformation in the Northwest. The Army Corps of Engineers selected the Priest Rapids Valley for its plutonium production facility, taking advantage of the area’s plentiful hydroelectric power, fresh water, and land. The removal of residents and subsequent construction of Hanford Engineer Works turned the Priest Rapids Valley from a farming community poised for growth with the aid of irrigation water into an industrial landscape that poisoned the land, water, and air over the next forty years. Clean up of the site will last longer than Hanford actively produced plutonium and cost much more. The Department of Energy estimates that clean up will cost upwards of $640 billion and not be complete until 2078, more than 130 years after the first reactor began operation.5

The war did not precipitate an all-out clear cut of Northwest forests. The rate and extent of extraction in the region’s forests largely followed prewar patterns. Harvests increased during the war years to meet the demands of the military and industry but did not rise above prewar levels. The wartime rate of harvest was nonetheless unsustainable, leaving the region’s private forest stands unable to regenerate. The limitations that kept harvests in check during the war, i.e.,

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labor shortages, limited access to technology, and the federal government’s commitment to conservation, largely vanished after the war. The postwar housing boom in the US, reconstruction in Europe and Japan, and remobilization for the Korean War and larger Cold War accelerated demand for forest products. The minimal constraints on extraction combined with this increased demand left Northwest forests open to exploitation in the postwar era.⁶

World War II transformed the economic landscape of the Pacific Northwest. The growth of war industries contributed to the diversification of the region’s economy beyond extractive industries. New industries like aluminum and light metals processing emerged in the region to take advantage of inexpensive power from the Columbia River’s dams. The war also spurred the growth of shipbuilding and aircraft manufacturing industries. The expansion of war industries and their continued presence after the war largely fulfilled planners’ goal of economic diversification. These industries also generated new networks of capital and commodities in the Northwest. The federal government awarded more than $2 billion in defense contracts to Portland-area firms and approximately $5.6 billion to manufacturers in Seattle.⁷ The billions of dollars spent in the Northwest produced weapons and materiel that were distributed across the globe in support of the Allied war effort.

The war strengthened the connections between the Pacific Northwest and the federal government. The federal government, not private industries, financed the physical infrastructure

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needed to expand production to meet the needs of war, taking on all the economic risk itself. The construction of the major industrial facilities in the Northwest, including Bonneville and Grand Coulee Dams, Hanford Engineer Works, Boeing’s plants in Seattle and Renton, five aluminum plants, and nine shipyards, cost the federal government nearly $1 billion. The money spent by the federal government and the infrastructure it built provided the foundation for the region’s postwar growth and prosperity. The relationship that developed between the federal government and manufacturers during the war, especially with Boeing, created a lasting military-industrial complex in the Northwest.

Evidence of wartime changes to the Pacific Northwest remain visible on the landscape and continue to impact residents and their environments today. On Swan Island in Portland at the

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8 “Statement of the Secretary of the Interior, Harold L. Ickes, Before the United States Senate Special Committee to Investigate the National Defense Program, June 16, 1941,” p. 6, Box 335, Harold L. Ickes Papers, Library of Congress.


10 For more on the postwar economy of the Northwest and its shift toward high-tech industries and tourism, please see Christopher P. Foss, *Facing the World: Defense Spending and International Trade in the Pacific Northwest Since World War II* (Corvallis: Oregon State University Press, 2020).
site of Kaiser’s Swan Island Shipyards, Vigor Industries repairs ships using North America’s largest drydock. At the company’s other Northwest shipyard, on Harbor Island in Seattle at the site of the former Todd Shipyards Corporation’s yard, workers built and repair many of the Washington State Ferries still operating today. To the east, Hanford remains a key economic driver in the Columbia Basin, but now workers focus their efforts on research and remediation of plutonium production waste. Along the Columbia River, server farms for Google and Amazon draw power from dams originally intended to power aluminum plants. If you travel by air to or from the Northwest, you are likely aboard a Boeing 737, assembled at the company’s Renton plant originally built by the Navy in 1941. Following resources from forest to factory from World War II to today reveals the far-reaching effects of war for the Pacific Northwest.
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Macica has published work on environmental history in several edited volumes. She has presented papers at conferences for the American Society for Environmental History, National Council on Public History, and Organization of American Historians, among others. As a public historian, she has worked in a variety of archives and museums, including the National Archives at Seattle, Winnetka Historical Society, and the Library of Congress.