

## CHAPTER FORTY-ONE

# Environmental Dimensions of World War II

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World War II was wide ranging in its human, animal, and material destruction, it halted certain political ideologies in their tracks and strengthened others, and entailed the mobilization of natural resources on an unprecedented scale. And yet scholars have been slow to assess the war's environmental dimensions. Scholars of the war itself seldom look at it through an environmental lens, and environmental historians are often preoccupied with peacetime changes to the natural environment. There remains ample room for research and interpretation, and questions abound. What were the short- or long-term impacts of the war on the natural landscape, whether from bombing, construction, or the large-scale manipulations of terrain for tactical or strategic advantage? What were the opportunities and constraints of topography, natural resources, climate, and disease, in the actual prosecution of the war? How did the competing political ideologies in the war adopt differing views on wildlife and resource conservation, from Hitler's vegetarianism to the Americans' technological fixes? Can we find in World War II the roots of contemporary environmental science and social thought, even though the environmental movement typically is associated with the 1960s?

The present chapter attempts no comprehensive answer to these questions, but instead introduces some of the themes, questions, and controversies around which scholars have situated their work. These often overlap, but broadly stated they are: the global struggle for natural resources, the natural transformations due to war mobilization, the environmental impacts of combat, the rise in environmental sciences, and the role of the natural world within political ideology.

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Was World War II a fundamental episode in the rise of environmental consciousness? There is some debate about the origins of the environmental movement, and many

historians focus on postwar affluence, suburbanization, the critique of pesticide use, or the continuation of prewar debates about conservation and wilderness protection (Hays 1987). Others look to the atomic bomb or the worldwide contamination from nuclear tests in the 1950s (Worster 1994). But World War II is also rich territory for understanding environmental consciousness because of the purported causes of the war, and the anxieties about resources by great powers on all sides.

One clue to understanding this perspective is to highlight what contemporary observers took to be the war's proximate causes. The first UN Specialized Agencies were all designed to address a perceived cause. Combating disease, starvation, and ignorance propelled the spirit of the World Health Organization, Food and Agriculture Organization, and UN Educational, Scientific, and Cultural Organization. Yet among scholars, other factors – the rise of Nazism and Japanese militarism, to name just two – routinely trump these naturalistic explanations. This was not so during the war itself. It may be that the tendency of the Axis powers to justify actions as the natural result of population pressure made these explanations less attractive after the war. Population pressure was a critical part of Hitler's embrace of *Lebensraum*, the notion that Germans needed more living space. Columbia University geographer George T. Renner (1944) argued that the war ultimately was about ownership of the materials in the natural environment that could be used industrially or commercially by man. "This Second World War," he wrote, "has been variously pictured as a war of ideologies, a race war, a religious war, a war of mad leaders, and a class revolution" (p. 430). It was all of those only superficially, he argued. At a deeper level, the war was the result of a major challenge to Anglo-American dominant control of the world's natural resources. He lamented the lack of attention to the links between geopolitics and human ecology.

Imagining access to natural resources as the principal cause of the war would be an example of environmental determinism, that is, that the conditions of the natural environment have determined the course of human events more than other causal factors such as culture, religion, or ethnic conflict. Environmental historians are chary of making such claims, and even authors comfortable with a large dose of naturalistic explanation of major world events, such as Jared Diamond (1997), acknowledge that the war might not have happened if, say, Adolph Hitler had died in childbirth. Nevertheless, environmental warnings since World War II have drawn implicitly from the belief that natural resources, climate, and population pressures can lead to such wars again. The awakening of consciousness about global resources is evident in numerous works from the immediate postwar period. Fairfield Osborn (the son of a well-known American paleontologist Henry Fairfield Osborn) published *Our Plundered Planet* in 1948, arguing for wise land use and warning about a future of dwindling global resources. Robertson (2008) reveals Osborn to be intensely critical of humanity's apparent war against nature – Osborn went so far as to complain that wartime caricatures of the Japanese as gorillas were unfair to the gorillas, because animals did not have the warlike tendencies or destructive impulses of man. William Vogt, in a 1948 review of Osborn's book, called humankind "the only animal that deliberately destroys the environment on which its survival depends." In the same year Vogt wrote *The Road to Survival*, which revived Malthusian fears of population outstripping the food supply and called for curbs on growth. Vogt complained that Americans used machines to extract far more than their fair share, and only delayed

their ecological judgment day. The war itself had created its own kind of judgment day around the world. Commenting on the United States' Marshall Plan to rebuild Europe with massive capital investment after the war, ecologist Charles Elton pointed out that the Americans were trying to delay the natural consequences of the war.

As Linnr (2003) demonstrates, the Malthusian frame of mind never disappeared after these early commentators, and the issue would boil to the surface in the early 1970s in discussions about Paul Ehrlich's 1968 *The Population Bomb* and other works that pointed to the consequences of population pressures. Given the sensitivity of environmental historians to the arguments from that later era, it is difficult to underestimate the impact of these works. And examples from World War II have slipped into more contemporary debates. For example, concerns about global warming and other worldwide pressures such as population growth and access to water have heightened interest in the environmental dimensions of international security. Scholars writing about food and water security, such as Thomas Homer-Dixon (1991), see the importance of these pressures as axiomatic, and have attempted to formulate theoretical approaches to relate environmental degradation to acute conflict. Homer-Dixon also made the intriguing suggestion (1994) that there are fewer resource-based armed conflicts over renewable resources than nonrenewables. The classic case has been Japan's southward invasions in search of oil resources during World War II (Westing 1986; Homer-Dixon 1994).

Because of the disruption of markets and the reorientation of supply networks, the war itself offers historians a unique opportunity to evaluate the global reconfiguration of humans, animals, insects, and natural products. Strategic commodities crucial for military and economic strength, such as petroleum, copper, aluminum, and rubber, all depended on access to specific geographic regions. In his analysis of aluminum, recently Matthew Evenden (2011) noted that the war "drove an unprecedented search for resources at a global scale," resulting in intensified use of, and sometimes entirely new, commodity chains. His approach is ecological, seeing the interdependence of bauxite mines in British Guiana, cryolite mines in Greenland, smelting facilities in Quebec, and numerous other critical junctures in the production and shipping of aluminum for the war effort. Evenden (2009) argued that the war overrode preexisting political constraints on large-scale development schemes as well, such as massive dams for the use of hydroelectric power. It also displaced previous regimes of control. Prior to the war, provincial governments regulated hydroelectric power. During the war, all control shifted to the federal government. Drawing on the power of political propaganda, complete with images of fists coming out of rivers, the Canadian government mobilized the economy by rationalizing it – leading to an extraordinary level of centralized planning.

Because of mobilization and various "crash" programs to develop weapons, build harbors, and produce food, services, and armaments, World War II is a case study to see the transformation of the natural environment under sudden, relatively uncontested, seizure by state power. Scholars draw, explicitly or implicitly, from the post-modern critique of modernization and development (much of which is not about World War II, but rather about development schemes during the cold war). What was once perceived as rational and scientific has been described as disruptive, unnatural, and the result of widespread hubris among experts. The ranks of environmental historians are filled with those who trace the unintended consequences of such

“high modernist” schemes, as political scientist James Scott describes them. Scott’s *Seeing Like a State* (1998) argued that states have attempted to make their subjects and lands “legible,” transforming them through rationalization schemes of many stripes. These include land and water use, dictating the shapes of parcels of land, and micromanaging development schemes according to scientists’ or economists’ advice.

To focus on the consequences of extracting and trading a particular wartime commodity is to follow a time-honored pattern among environmental historians. As a conceptual tool, “commodified nature” is an echo of Karl Marx’s “commodified labor,” as discussed in *Capital*, and it has exercised a powerful influence upon the field of environmental history. Influential texts such as Donald Worster’s *Nature’s Economy* (1994) and Ted Steinberg’s *Down to Earth* (2002) both of which are widely used as textbooks in university courses, include critiques of capitalistic values that are in keeping with Marx but also sympathize with Henry David Thoreau’s nineteenth century assertion that Americans look at a tree and see a chair. On the global scale, Richard Tucker’s work on the degradation of the tropical world due to market demands and American corporations (backed by American military forces), provides detailed accounts of the transformation of landscapes to emphasize the most profitable crops for global markets (monocropping, or monoculture). This oft-repeated pattern – sugar in Cuba, bananas in Central America, for example – was well established by World War II. The results were typical: dependence of locals upon foreign corporations for basic services, dependence upon foreign markets for basic food needs, and completely obeisance by local politicians to foreign dictates (Tucker 2000).

In most narratives, the war heightened these trends and compounded them with comparatively weak attention to long-term conservation practices. Tucker (2004) shows how much better equipped nations were to commandeer forest resources even between the two world wars. World War II wrought enormous damage on a truly global scale to boreal, temperate, and tropical forests. In combat operations, forests lands were reclaimed for use in air bases and training camps, while the fighting itself destroyed much more. But most of the damage to forests came in the form of clear-cutting, away from combat zones. As German forces marched into France, Tucker points out, they were careful to preserve the French sawmills. Given the lack of reliable imports, European forest cutting increased dramatically. Yet there is some evidence that suggests that German forest managers were sophisticated in their approach to sustainable forest management, and it drew the admiration of American occupiers. Tucker argues that the Germans had learned a lesson from World War I, during which a naval blockade had starved Germany of wood. Nevertheless, though Germany managed its own forests efficiently, it was much more aggressive in cutting down trees in the east, particularly in occupied Poland, Czechoslovakia, Yugoslavia, Rumania, and the Baltic States. And when the war ended, coal shortages compelled more wanton cutting of trees even in Germany. Tucker argues that elsewhere emergency war measures undermined forest management, paving the way for “unrestrained capitalist exploitation of forest resources” after the war (Tucker 2004, p. 124).

Those with greater access to global trade made ample use of it. When Germany’s conquest of Norway cut off Britain’s access to Scandinavian boreal forests, Britain turned to its own forests, ignoring laws that had protected them for centuries. In addition, it drew heavily upon imports from the United States and Canada. These demands, compounded by American entry into the war against both Japan and

Germany in late 1941, turned World War II into a "lumberman's carnival," in the words of American forester William Greeley (p. 126). In Tucker's view, this was a mixed blessing for American forests, particularly in the Pacific Northwest. On the one hand, extraordinary numbers of trees were cut down. On the other, the high value of lumber led Americans to abandon seeing it as an endless resource, and to invest heavily in replanting projects. Meanwhile, the Japanese occupation of former British Malaya, French Indochina, and Dutch Indonesia apparently dismantled years of forest management for the greater needs of the Japanese military and naval forces. The Dutch destroyed their logging facilities when they retreated from teak plantations in Java, but the Japanese imposed a forced labor system to have the Javanese cut down trees at a furious pace over more than three years of occupation. Tucker's thesis is that the war opened a door toward unsustainable practices, most of which occurred during peacetime after the war ended. In Latin America, for example, the war gave American firms a foothold for timber exploitation from Mexico all the way to Argentina.

Investigating such pressure upon natural resources presents historians with the opportunity to highlight political and social tensions. For example, resource demands during the war put extraordinary strains on colonial holdings and planted seeds of discord that lasted into the postwar years. In the case of Rhodesia, Samasuwo (2003) argues, Allied demand for beef allowed local authorities to requisition cattle forcibly in ways that fed African nationalism after the war. Intensive land use and the changing ownership of cattle deepened the impact of colonialism and fostered high levels of resentment. Other scholars use these pressures to resolve questions of culpability for national catastrophes. For example, in the latter half of the Japanese occupation of Vietnam, between one and two million people starved to death. Naturalistic explanations of the famine include bad weather, flooding, and the inability to respond efficiently in the frantic situation of wartime Southeast Asia. The French after the war widened the blame to include Allied bombing, particularly its role in impairing rail and road systems. Bùi Minh Dũng (1995) disagrees, pointing out that most explanations fail to account for the resiliency of the population in previous crises. Instead Dũng claims that Japan gradually converted land use from rice to strategic commodities such as textiles (mainly cotton) and plant oils (such as peanut and castor oil) on a huge scale, and even converted some of its rubber plantations to cotton cultivation. Some rice was grown, only to be exported to Japan, stored for later use, sold elsewhere, or simply destroyed. Peasants were forced to convert their crops to commodities in the service of the Japanese Empire, leading in 1944 and 1945 to widespread starvation, desperate migrations, and even cannibalism.

Two commodities have earned considerable attention from scholars: rubber and uranium. When Japan took control of Southeast Asia, it robbed European empires of the world's main source of rubber. The United States, which previously relied on British Malaya for some ninety percent of its rubber, scrambled to find other sources. In doing so, it subsidized a massive reorientation of Brazil's Amazonian rubber trees, a process that included the movement of some 52,000 Brazilians (workers and their families) into the area. By the end of the war, 23,000 of them were dead or missing. Scholars such as Dean (1987) have tended to emphasize the victimization of these workers, who had suffered from the impacts of drought and were desperate enough to go into a region rife with malaria and inadequate sustenance. Some even have compared the migration to forced-work concentration camps in Nazi Europe. But

Garfield (2010) argues that pointing fingers at the Americans or opportunistic local oligarchs oversimplifies the problem, and it is misleading to portray the migrants as "dragooned." State-sponsored migrations could also be perceived as humanitarian and patriotic. During the drought of 1942–1943, Brazilian authorities promoted migration out of the at-risk towns, and the American subsidy appeared as an opportunity to facilitate that.

The American efforts to develop a synthetic form of rubber during the war have sparked considerable interest from environmental historians and historians of science and technology. One perspective would see the story as a "technological fix" for a resource shortfall, with World War II creating a mutually beneficial partnership between the chemical industry and the US government. Mark Finlay's (2009) analysis runs deeper than that, seeing political forces within the American agricultural sector ultimately favoring petroleum interests over grain interests. The key chemical product in synthesizing rubber was butadiene, derived from either grain-based alcohol or petroleum. Both were produced on a large scale in the United States, and both had powerful lobbies in Washington. Petroleum-based rubber was cheaper, but grain-based rubber would have addressed grain over-production while decreasing the dependence of the United States on foreign oil.

Perhaps the most notorious commodity has been uranium. Albert Einstein's famous 1939 letter to President Roosevelt, about Germany's discovery of fission and its implications for atomic bombs, included the advice to secure a source of uranium from the Belgian Congo. The United States benefited from having a cache of uranium from the Congo to make its first bombs, but both the United States and Canada developed mining operations. For those who choose to pay any attention to it, the history of uranium mining is grim material. Norman Naimark's (1997) discussion of the uranium mines in Germany and Czechoslovakia, taken over by the Soviets at the end of the war, leave little doubt that the harm to miners from radiation exposure was callously set aside for the superior aim of attaining fuel for an atomic bomb. His discussion of workers wading in radioactive sludge raises serious questions about how radiation safety was handled elsewhere, particularly by the Americans, who progressed much farther in bomb work during the war.

Scholarship on uranium mining in the United States is closely tied to literature on environmental justice, because most of the mining occurred on Native American land, and the mining work fell predominantly upon Navajo people in the southwest United States. For years, advocacy groups have claimed that many health problems among the Navajo can be attributed to mining operations. Histories of nuclear weapons, nuclear power, and even of radiation health safety, typically ignore the issue or tread lightly upon it, following the industry's cue by not considering mining as part of the nuclear fuel cycle. However, this is changing and more scholarship is needed to bring the perspectives of environmental justice and environmental history together with history of science and nuclear history. One reason for the change has been the 1990 passage of Radiation Exposure Compensation Act by the United States Congress, which implicitly acknowledges that such human damage may have occurred. Although that legislation was designed to help miners and the "down-winders" from postwar nuclear tests, many Navajo had difficulty seeking redress. Brugge, Benally, and Yazzie-Lewis (2006) have attempted to bring these voices to a broader audience through oral histories and commentary, but the process is slow and involves contentious litigation.

To what can historians attribute cases of clear environmental harm? Were these practices in keeping with the norms of the time, based on contemporary scientific knowledge? Or were these problems simply swept aside for wartime expediency? And if they were swept aside, were the problems addressed at war's end, or simply continued in the postwar years? Jenks (2007) tells the story of a particular site in New York, first requisitioned for TNT production and eventually used as a chemical and radioactive waste dumping ground. He argues that the feverish pace of the Manhattan Project left ample justification to raise exposure levels at production facilities and, at war's end, little sense of responsibility for ensuring that contaminated sites were cleaned up or contained. Those practices set a standard that would continue long into the postwar era. Such sites, often maintained privately and only connected to the government by contract, routinely escape notice by anyone, including historians.

At more well known nuclear sites, the legacy of the war remains controversial. At Hanford, in eastern Washington State, the United States built the first major plutonium production facility, using the ample supplies of hydroelectricity and cooling water from the Columbia River. Hanford created the fuel for one of the atomic bombs used against Japan (the one that destroyed Nagasaki). The fuel for the other bomb, uranium-235, had been produced at the Oak Ridge site, powered by the enormous New Deal project, the Tennessee Valley Authority. At Hanford, plutonium production also created a toxic site, because Hanford workers dumped contaminated water into the Columbia River and released radioactive isotopes such as iodine-131 into the atmosphere. Scientists' wartime assumptions about the fate of these radioactive pollutants – that they would bond with the soil or dissipate – proved incorrect (Gerber 1997). The secrecy surrounding the site continued after the war. The details of the contamination were not widely known until 1986, when the US Department of Energy began to point out the need for a major cleanup effort. As Bauman (2007) notes, the “Hanford site is often either celebrated as a place of heroic, scientific pioneers or denigrated as a disgraceful atomic wasteland.” He argues that public history, targeting undergraduate education and the wider public, is one of the ways to break the heroic mindset and to see the site as the nexus of several environmental, demographic, and racial struggles.

To see such links requires historians to move outside the confines of the war itself, and to gauge the ways that war mobilization and fighting changed human interactions with the natural world in the long term. For example, the evacuation of families from cities to the countryside in Britain during the Blitz temporarily reversed the pattern of industrialization and opened up numerous questions of social policy. Aside from the public health concerns attendant to such migrations, Richard Titmuss (1950) argued that the experience drew attention to problems of poverty and malnourishment, and led to clamoring for equal apportionment of the country's resources in food, milk, and other commodities. Historians of social policy in Britain continue to argue about whether the evacuation changed or reinforced views about class differences, but rationing in the war and the interactions among so many different walks of life in unfamiliar surroundings may have created a mood for social reform. Welshman (1999) argues that the evacuation of schoolchildren in particular opened a longstanding dialogue about the importance of environmental factors in health, crime, and poverty.

Gerald Nash has set the tone of discussion about the transformation of the American West during the war. In two books, *The American West Transformed* (1985) and

*World War II and the West* (1990), he explicitly identified the mobilization of the war effort as a decisive moment in altering the history of the western states. Prior to 1941, he contends, the West was a sparsely populated backwater, a colony, America's "Third World." Like European colonies, the West essentially provided natural resources for manufacturing centers located in the eastern states, with no massive urban centers to claim as its own. But because of the Pacific war, cities like Seattle, Portland, and San Francisco mushroomed in size and importance, building the shipyards to strengthen America's Pacific fleet. The aircraft industry similarly boosted Seattle and the Los Angeles area. Workers migrated in huge numbers, with some seven million moving to the West in just four years of war. The story of this migration also is fundamental to American social history, with numerous studies of race relations using as a jumping off point the settlement and labor patterns established during the war years. African Americans moved out of the Southeast and came to California in the search for defense-related work, creating tensions not only with white people but also with Latinos, some of whom also were immigrants crossing the border from Mexico looking for work. Nash's upbeat attitude about the positive aspects of these demographic changes has come under fire from some scholars who would stress the resultant racial tensions, exemplified by the Zoot Suit riots of 1943. In addition, the positive spin downplays the fact that displacement of Native Americans from their lands only intensified during the war, and Japanese-Americans were interned in camps. James Gregory (1991) argues that Nash oversimplified the situation by calling the prewar West a backwater, ignoring the importance of California to Pacific trade and the preexisting economic expansion that the war may simply have accelerated rather than triggered. Richard Lowitt's (1984) interpretation, published prior to Nash's books, credits President Franklin Roosevelt's New Deal policies of the 1930s for changing the West from a plundered region – for its oil, water, forests, wildlife, and mines – into a highly managed region based on principles of resource conservation. This interpretation is in keeping with environmental historians who see federal intervention, particularly the drive toward more efficient land use, as a response to the disastrous Dust Bowl of the early 1930s.

It does seem clear from recent historical work that the major combatants tried to bring scientific knowledge to bear on their ability to exploit the natural environment and to operate within it. Knowledge of natural resources and the peoples of the earth proved deficient enough during the war that combatants attempted to remedy their knowledge in a variety of ways. Farish (2005) notes that the war stimulated a mutually beneficial collaboration between geographers and the military. Academics gathered a vast amount of data for the war effort. He argues that for Americans, the war radically reshaped this relationship, leading to strong regional intelligence services designed to blend national aims with local knowledge. Farish notes that this also led to the proliferation of "area studies" during the cold war. Such work involved not only intelligence-gathering about people and natural resources, but also finding ways to survive in unfamiliar environments from the tropical Pacific islands, deserts of North Africa, to the snowy Aleutians. The US government routinely sent scientists along with armed forces, particularly in the Pacific, with its many problems of climate, disease, and organisms yet unknown to science.

Although the role of World War II in stimulating technological developments such as the atomic bomb and penicillin is well known, the war's impacts on the environmental



sciences are less understood. The postwar growth of oceanography and marine geology as disciplines in the United States, often in partnership with the US Navy, resulted directly from relationships developed during World War II. Pacific campaigns were voyages of discovery as well. While serving in the US Navy, for example, Princeton geologist Harry Hess discovered undersea peaks (he called them guyots). Other work was directed at combat operations. For example, military commanders realized that the 1943 amphibious landing disaster at Tarawa was the result of inadequate knowledge of oceans and tidal conditions. The marines had tried to land on the beach at low tide, which meant they had to wade through shallow water over a long distance, while subject to machine gun fire from the Japanese. Thousands of marines died because of inadequate scientific knowledge. Similarly, oceanographers and meteorologists set up ocean and weather monitoring stations in Britain to help prosecute the war in Europe. General Eisenhower used these scientists to plan the timing for the invasion of Normandy on June 6, 1944. The desire for operational knowledge of the natural environment cemented the relationship between the armed services and scientists, and the US military would continue after the war to be the dominant patron of scientific research in the ocean and atmospheric sciences (Weir 2001; Hamblin 2005).

The war also stimulated work in ecology. One example is a matter of timing: the American Raymond Lindeman's influential work on the passage of energy within an ecosystem was published during the war. But there were very practical questions about agricultural defense that enrolled ecologists. For example, Oxford's Charles Elton oriented his colleagues toward rodent control during the war, initiating a flurry of work on rats, mice, and rabbits (Crowcroft 1991). Others investigated mosquitoes and locusts, and the various chemical measures to control them. This wartime work, much of it done collaboratively between the UK and the United States, also led to the large-scale production of herbicides and plant hormones to control weeds and clear underbrush. Pringle (1975) argued that without the war, there would not have been such a proliferation of the variety of herbicides in the postwar years. In the Pacific region, the movement of tens of thousands of American marines in and out of one island or another posed enormous risks of infectious disease and ecosystem disruption. Bennett (2004) reveals the intersection of existing colonial expertise by British and French scientists and the American island-hoppers. American horses had brought ticks to New Caledonia, leading to the death by tick-borne disease to local cattle. The Americans violated quarantine rules established by the French, and some British scientists were convinced that the Americans would spread malaria in the islands like wildfire, carried by mosquitoes feasting on their blood. Although a malaria epidemic never materialized, the tick problem would plague the Pacific islands after the war.

These studies speak to a question at the intersection of environmental history and the history of science: to what extent are ecological outlooks informed by political ideology? Peder Anker (2001) writes that ecological arguments were used repeatedly to prop up not only nationalism, but also to justify the apartheid regime in South Africa (all things having their proper place or niche). During the war and its aftermath, British ecologists affirmed global interdependence in a way that deemphasized human agency and helped to justify the need for management and control, such as the creation of far-reaching international bodies.

Russell (1996) raises a disturbing link between insect control and the language of total war. Just as ecologists tried to understand the behavior and life cycles of rats and mice to control them, Russell suggests that chemical research focused less on control and more on extermination. Fumigation for insect control at prison camps allegedly inspired the first use of an insecticide, Zyklon B, on humans at Auschwitz – first on Soviet prisoners of war, then on Jews and others on a large scale. In the Pacific theater of war, American propaganda described the Japanese as vermin to be annihilated. According to Russell, this was more prevalent in anti-Japanese propaganda than in anti-German propaganda. The imagery of Japanese as vermin, insects, spiders, scorpions, and other pests, Russell notes, must have made it “natural” to talk of extermination. American Admiral William F. Halsey referred to the Japanese as gophers, and other American leaders used the word extermination routinely. After the war, the metaphor reversed course, allowing chemical companies to focus not on insect control but on total annihilation of insect species.

Although historians conventionally identify casualties by the cause of death – that is, in combat, of disease, or of starvation – these presume an easily discerned separation. To what extent did combatants manipulate natural causes to their advantage? Most of the major combatants experimented with biological and chemical weapons during the war. Some of this involved human experimentation, most notoriously on the effects of chemical burns, conducted in Nazi concentration camps, and on a variety of disease pathogens on Chinese and Korean prisoners in Japan’s research facilities in Manchuria. Harris (1994) gives excruciating details of the Japanese Unit 731, set up in Manchuria and led by biologist Shiro Ishii. The Japanese attempted not only to experiment on humans with chemical weapons, but also to attempt to infect humans with diseases by using natural insect vectors. Harris also demonstrates that American occupiers understood that this had been done and, in exchange for the data, did not prosecute the Japanese scientists for war crimes. In Britain, one noted case of biological weapons research was Gruinard Island (off Scotland), where in 1942 and 1943 scientists had experimented with bombs containing anthrax spores to kill sheep. The entire island had to be abandoned because the scientists were unsure where all the contaminated soil was. Balmer (2001) notes that these experiments were a response to rumors of a planned chemical or biological attack by Germany on the London Underground rail system, and were designed to test Britain’s retaliatory ability. Lockwood (2008) reveals the enrolment of entomologists into such work, not only in the case of Japan, but at the American research facility at Camp Detrick, Maryland.

On the subject of bugs, more widely known is the role during World War II of insect control measures. One controversial aspect of combat zone technologies has been the legacy of dichlorodiphenyltrichloroethane, or DDT. At war’s end, it had a reputation as a crucial element of the Allies’ arsenal, having saved many lives that otherwise might have perished from tropical mosquito-borne diseases. Paul Müller won the Nobel Prize (for Physiology or Medicine) in 1948 for his role in developing it. And yet it earned a negative reputation in subsequent decades due to indiscriminate spraying and DDT’s links to cancer – mentioned most prominently in Rachel Carson’s 1962 bestseller *Silent Spring*. The turn against DDT features prominently in orthodox narratives about the rise of the environmental movement after World War II. Hays (1987) argued that regulators during the war era were most concerned with whether chemicals were as effective in killing insects as developers claimed, with little

attention to health or environmental consequences. That would change by the 1960s, and Dunlap (1981) notes the importance of activism and public consternation, exerting political pressure from outside traditional government advisory structures. Shulman's (1992) work on toxic military installations in the years since the war plays up the notion that DDT's military origins may not have been conducive to rigorous health or environmental standards. And yet Edmund Russell (1999) has documented wartime measures by the US Army and the Public Health Service that prohibited indiscriminate spraying and warned against the possible links to cancer. He argues that even during World War II, government scientists recognized the dangers, issued cautions, and restricted DDT's use. Instead of looking at a rise in consciousness or new methods of emphasizing policy, Russell sees structural similarities in federal control between 1945 and 1972 (when DDT was banned in the United States under new federal regulations). During World War II, mobilization and centralized planning went hand in hand, but the country transitioned to decentralized and local politics after the war. Ironically, the federal government essentially created a new industry of mass-produced DDT, but it was unable to control that industry once the war ended.

Such work suggests that political culture has a great deal to do with the uses or abuses of the natural world. Examining environmental ideas during the war has allowed scholars to explore what Douglas Weiner (1992) calls the "hidden history" of environmentalism, embedded in the political ideologies that vied for influence in the 1930s and ultimately clashed in World War II: fascism, communism, and liberalism. Environmental historians routinely criticize the rapacious practices of free markets and capitalism, and there has been a spate of recent work on Nazism. Less work has been accomplished on communism. Much work on the Soviet side has focused on environmental degradation beginning in the Stalin years and continuing relatively unabated until the fall of the Soviet Union. Weiner (1999) suggests that ecologists came under fire for suggesting that there might be limits to humans' ability to transform the natural world. Soviet ideology emphasized the use of science and technology to modernize the economy and to centralize planning, so such skepticism was not welcome. And yet Weiner also points out that conservationists were able to find key political allies and to earn "a little corner of freedom," from which they protected animals (such as the European bison) from over-hunting during the war.

The appeal of reexamining environmental attitudes in these regimes, aside from their intrinsic value as scholarship, may be the irony of seeing unexpectedly progressive views emerge from the Axis powers. While Roosevelt, Churchill, and Stalin all were smokers, for example, Hitler, Mussolini, and Franco apparently were not. But the differences ran more deeply. In *The Nazi War on Cancer* (1999), Robert Proctor showed the extent to which the Nazi regime attempted to limit the public health effects of second-hand smoke (or "passive smoking"). He also revealed how American tobacco companies used this to their advantage, calling their opponents crypto-fascists and complaining about efforts to put smokers in "ghettos." The Nazi "war" was ideologically linked to its attempts to purify Germany from all forms of cancer, including human ones. This lent nature protection in Germany a decidedly racist, authoritarian flavor. Other similarities to later environmentalists – Hitler's vegetarianism, an emphasis on whole grains and organic produce, nature protection laws, and a surprising respect for integrating high modernist architecture with the existing natural landscape, gave later Green politics a troubled legacy. The Greens seemed "brown" on the inside.

Others see the links less in "purity" and more in Nazi ideology's rejection of the mechanical, scientific vision of human relations with the natural world. The notion of "blood and soil," identifying the German *Volk* with their land, was popularized by Minister of Agriculture Richard Walther Darré. In Anna Bramwell's (1985) telling, Darré's true sympathy was with the peasantry, the countryside, and their plights, but his ideas were co-opted and made ugly by the Nazis. Other authors criticize Bramwell's account for glossing over Darré's own anti-Semitism, and ignoring his role in the Holocaust. Gesine Gerhard (2005) argued that Bramwell's attempt to lionize landscape planner Darré as an early Green underplayed the links between his racism and land use policies. She and others in the edited volume *How Green Were the Nazis?* explicitly linked these ideas with racial purity (Brüggemeier, Cioc, and Zeller 2005).

Most scholars of Nazi conservation distance themselves from Bramwell's conclusions. Dominick (1992) sees the roots of modern environmentalism much earlier (such as Napoleonic-era natural philosopher Alexander von Humboldt), giving little credence to the Nazi period's formative influence. Uekötter (2006) denies that political ideology created a distinctive brand of conservation, citing the multitude of approaches in Germany during the 1930s. He sees little evidence of Nazi attempts to dictate the ethos of conservationists, though the Reich's zeal to protect national heritage strengthened the movement considerably. In his analysis, the institutional links were the most important drivers of change, rather than ideological ones.

The central concept in many of these studies is *Heimatschutz*, which might be translated as "homeland protection." Thomas Lekan writes about how both regional identity and national identity remained intact in Germany after its unification in 1871, and that rivers such as the Rhine often mediated between them. He argues (1999) that Nazi nature protection laws did not significantly improve upon preexisting regional and local agencies and private clubs oriented toward nature protection. Nazi laws may have given the preexisting rules and regulations a firm legal standing, but the regime's penchant for massive public works projects created discord with those groups. The respect of *Heimat*, and the notion that certain people belonged to particular regions, meant a considerable sense of care in development issues, but it seems that the national government's view of *Heimat* was not always consistent with regional views. Thomas Zeller's (2007) study of the Autobahn shows the heated negotiations between construction engineers and landscape planners, both of whom argued that their designs would return the German land to their natural state. Zeller puts more stock in rhetoric and individual influences than an organized "Nazi" approach to nature protection during the Autobahn's construction. As Coen (2008) notes, several contemporary authors disagree about whether the strong nature protection movement before and during the war was primarily a Nazi innovation or a product of disillusionment with the Weimar regime, or even a result of militaristic regionalism from World War I.

How did the war itself change how people interacted with the natural environment? The forced migrations and mass murders of people in Eastern Europe during the war had devastating consequences well known to historians of war and genocide. Less well studied are the changing uses of the land under different political cultures. After Hitler's invasion of Poland, Germany and the Soviet Union exerted enormous influence over previously independent states from the Baltic to the Black Seas. Many of these countries suffered tremendous destruction and multiple occupations at the frontier between the Wehrmacht and Red Army.

In her study of Lithuania, Diana Mincyte shows how the Soviet land reforms – initially nationalization, and later forced food requisitions and high taxation – were intended to extract commodities on a large scale. She argues that this was resisted through “everyday environmentalism,” namely small-scale agricultural diversification. Farmers identified more with the land itself, considering themselves “bugs of the earth,” rather than the nature-conquering peasant-citizen in Stalinist discourse (p. 43).

Combatants drew upon images of the natural environment to shore up political support. The peasant-citizen was a powerful image in the process of collectivization throughout the Soviet sphere of influence. The Nazis attempted to blend notions of German-ness with the landscape. But also the natural landscape lent authenticity in a time of immense political uncertainty and flux. The “Forest Brothers” in the Baltic States were a catchall term describing anti-Soviet resistance fighters among Latvians, Estonians, and Lithuanians. The forests concealed them, provided them a source of nourishment, but also served a symbol that they were not the outsiders.

Looking to the west, Pearson (2006) argues that forests also became a crucial part of the Vichy government’s attempt to survive, on both material and symbolic levels. The forests were an important natural resource in southeastern France, and the Pétain government attempted to increase production of fuel, animal litter, bark, and charcoal. But more intriguingly, Pétain and others tried to blend forest imagery with their reactionary political views. Getting back to the land was deemed healthy for the body and soul, and leading Vichy politician Jacques Chevalier suggested that eternal France resided in the forest. It was the site of traditional values: work, family, country. Conversely, resistance fighters also tried to draw upon the forests’ power of authenticity, making it a site of revolt and subversion. Pétain famously named a particularly strong and tall oak tree after himself, and it later was dubbed the Oak of the Resistance.

Nature served as a symbol of resistance elsewhere, too. The forced removal and internment of Japanese-Americans in the United States has garnered some attention of scholars of environmental issues. Like the Lithuanian peasants in Mincyte’s telling, Japanese-Americans resisted on a small scale. Scholars such as Tamura (2004) have noted that the detainees improved their grim surroundings as strategies of survival and resistance, building what Helphand (2006) described as “defiant gardens.” Chiang (2010) takes a different approach, not focusing on the gardens as emblems of resistance, but instead investigating how the natural environment challenged or reinforced race-based imprisonment. The US government located the camps in places that were isolated, intending to exploit detainee labor, she argues, but soon found them to be powerful symbols of the American war effort. Chiang argues that the extent of Japanese-Americans’ transformations of the landscape helped them to frame their activities as patriotic – like the “victory gardens” throughout the country – a characterization encouraged by camp administrators.

In Japan itself, it is clear that the war entailed fundamental changes to the natural environment. Brett Walker’s *Toxic Archipelago* (2010) maps out the multiple causes of suffering and disease by Japan’s people during the twentieth century. Though not limited to World War II, Walker reveals that the pursuit of national power through the Japanese imperial period led to extraordinary levels of complicity in hurting people by poisoning the natural environment with industrial toxins. Walker’s outlook differs from the orthodox view of many environmental historians who blame capitalist

structures for environmental degradation. Instead, he puts the onus of responsibility on the modern state, with its pursuit of national power.

William Tsutsui (2003) has pointed out that the pressure of "total war" reshaped the management of natural resources and Japanese perceptions of nature. Although the dropping of atomic bombs would leave a lasting cultural impression within Japan, the wartime exigencies of supply also made dramatic physical changes to the landscape. He identifies four distinct causes of environmental change: direct damage from bombing, indirect damage from economic and military mobilization, the repercussions of wartime scarcities, and the ramifications of Japan's disengagement from the global economy.

As destructive as they were, Tsutsui argues, the bombing of cities took a relatively insignificant toll on the natural environment, compared to the huge areas "tainted" by military bases, mines, and industry, and the vast tracts of land deforested for war purposes by the Japanese themselves. By 1945, the Japanese were cutting down some fifty square miles of forests per week. The pollution of air and water from the industrial and mining sites, along with the degradation of forestlands, were far and away more lasting than the effects of bombs. Tsutsui cites a 1947 survey of Hiroshima fauna as evidence that animal and insect populations had fully recovered even from the atomic bombings. And other developments have passed without much notice as well, such as the halt to global trade in Japan's pyrethrum – the standard insecticide, derived from dried flowers. Lacking it, Americans took the lead in developing powerful chemical insecticides such as DDT.

Tsutsui takes issue with the notion that war is inherently destructive upon the environment. Like many environmental writers, he sees peacetime activities by people as enormously exploitive and insensitive about the natural world. War, by curbing these activities, can be helpful to nature. Also, wartime scarcities could lead to practices – such as composting rather than using chemical fertilizers – that returned nutrients to the earth. Probably the most far-reaching example of human inactivity was in the area of fishing. Japan's dominance in Pacific deep-sea fishing ended during the war, as its fishermen stayed closer to safe home waters. At war's end, fishermen found abundant fish, even in areas thought to have been depleted long before the war.

Even in the countries that saw intense fighting and widespread environmental destruction, there is evidence that most of the environmental effects of the war were indirect, away from the fighting. In Finland, Laakkonen (2004) points out, the fierce standoff between Finns and Russians in the Finnish Winter War of 1939–1940 decimated vast areas of pine trees, and yet most of the war's impact there can be attributed to changing patterns of production and consumption. Air and water pollution from cities and the expansion of paper and pulp industries changed the natural environment of Finland more than combat itself. Granted, military forces cut down trees for their operations – and for wood-fired saunas – in great numbers, leaving a lasting imprint on the slow-growth taiga of the north. But fortunately, he says, much of the fighting took place below the Arctic Circle, where growth and recovery occurred more rapidly. The forest, he argues, saved the trees. Ironically, so did the fighting: after the conflict, uncleared mines and bullet-ridden trees made forests in the former war zone (now ceded to the Soviet Union) unappealing to loggers. On the Finnish side, however, more trees were cut after the war to rebuild a new eastern Finland. Laakkonen also suggests that wartime austerity may have made Finland more sustainable, by limiting

the consumption that led to environmental degradation in peacetime. Here Laakkonen makes the case that in Finland the ecological "bootprint" of war was much less than that of peace. This view is partly enforced by Lahtinen and Vuorisalo (2004) who point out the rise in recycling and urban agriculture. City dwellers grew their own crops, particularly potatoes, during tough times, and even kept chickens and other animals in their apartments. But overall Lahtinen and Vuorisalo conclude that the war led people to set aside their environmental sensibilities about pollution control, sanitation, and nature conservation. Keeping farm animals in one's apartment spoke volumes for what people were willing to put up with while they attempted to survive.

In deep-sea fishing, there appears to be consensus that the war allowed fish stocks to recover. It did not last very long, though, and the war itself helped to mask trends in overfishing that would continue after 1945. European marine science bodies, such as the International Council for the Exploration of the Sea (ICES), prioritized studies of maximum sustainable yields. They found that the stocks of fish in the North Atlantic had recovered during the war years, only to be overfished again at war's end (Rozwadowski 2002). These trends would become clear to fishermen and policymakers alike after the war. The California state legislature in 1947 established a special committee to address the apparent collapse of the state's lucrative sardine fisheries immediately after the war (McEvoy and Scheiber 1984).

The argument that the war allowed nature to recover tends to fail when applied to the land – after all, war mobilization typically increased land use and resource exploitation for the war effort, even if some kinds of civilian consumption decreased. The argument holds best when applied to areas that disallowed human economic activity – war zones and deep waters far from home. Kurk Dorsey (2004) has shown that the war gave whales a reprieve from the Germans, Scandinavians, and Japanese who dominated the industry. The United States had little stake in whaling prior to the war, and British vessels had been requisitioned for the war. But Dorsey cautions against the idea that the war was a holiday for whales. In fact the United States actively promoted whaling during the war, and the government encouraged consumers to try whale meat – which was not rationed. He also suggests that surface vessels killed many whales by exploding depth charges, mistaking them for submarines or using them for target practice. Whales became a strategic commodity, and after the war the United States seized the leadership role in regulating whaling, based on American-style resource management strategies from the progressive era. But the postwar food crisis, as well as powerful belief that the war had replenished the world's supply of whales, made conservation practices extraordinarily difficult to establish or enforce.

The notion that war has been "good for nature" has a certain amount of morbid appeal, but it also is in keeping with a consistent theme among environmental historians – namely, that peacetime practices by humans often have been unsustainable, and the worst practices have been encouraged by easy access to markets. It would be foolish to impose consensus upon environmental accounts of World War II, but it may be worth ending the present chapter on this particular point, because it pervades the historical literature and begs for more research. To put it simply, the war should not be seen as an aberration from practices that began before and continued long afterward. If true, scholars should not forget that most of the deep-seated ideas about the natural world have been set into practice during peacetime, even if the war may have accelerated them, made them glaringly obvious, or in some cases mitigated them.

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