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Hydroponic Imperialism: Race, Hygiene and Agro-Technology in Occupied Japan, 1945–60¹

Abhishek Nanavati

Introduction

Following Japan's surrender at the end of the Second World War, US occupation forces attempted to create their own biosphere – an ideal environment that was tuned to a 'modern American' lifestyle – within Japan. The US military tried to create a hermetically-sealed food production and supply system that would guarantee hygienic and nutritious produce suiting the occupiers' standards and bodies.² The challenge of supplying the necessary nutrition for the healthy development of American forces and their families was shaped by anxiety over Japanese soil. Medical officers worried that the historical use of 'night soil' – treated human waste used to fertilize crops – had contaminated the archipelago. The US Army used cutting-edge hydroponic technology to overcome perceived environmental barriers, produce familiar vegetables and provide them to its growing forces. Through their desire to standardize vegetable production and protect the health of occupying personnel, they developed something radical: a soilless farm theoretically operable anywhere in the world. At the same time, the US military's efforts to create occupied spaces were deeply intertwined with ideas of racial hygiene, and colonial ideas of environmental control and the desirability of Western crops, as well as the use of Japanese soil as a stage for technological experimentation.

This chapter examines the dynamics of public hygiene as it relates to space in occupied Japan. It argues that something as simple as food production relied on ideas of race and race making. There was a hygienic hierarchy in the territories occupied by the US military. While the racial issue I address in this chapter focuses on the military's construction of a 'Japanese-ness', and more broadly, an 'Asian-ness', it was being viewed by Americans in opposition to whiteness. When

military commanders and medical officers, mostly white, conceived of a hygienic body, they thought of a white body – though they may have thought of it as an ‘American’ body. Moreover, American leaders referred to the country as an ‘alloyed but firmly Anglo-Saxon Christian society’ (Perry 1980: 170). Thus, when the military thought of ideal hygienic practices and diet, they thought of what came through middle- to upper-middle class Anglo-Saxon Christian traditions. They did not think of collard greens and corn dumplings; they thought of roast beef and gravy or scalloped cabbage (Office of the Quartermaster Military Planning Division 1946: 16).

This chapter combines military and environmental history with the history of technology to explore how the military-base-as-colonial-outpost was built on the fear of occupied land, where soil and terrain were read as extensions of the colonized subject (Gillem 2007; Lutz 2009; Höhn and Moon 2010). By focusing on US forces in Japan’s ecological landscape we can see how ideas of race and natural environment affected the development of military settlements, as well as the development of agro-technology in occupied Japan.

Military families, race and space in occupied Japan

While the occupation of Japan was chiefly an American endeavour, troops from several states, including Australia and New Zealand, also occupied bases in Japan. Their numbers peaked in early 1946, and by 1950 most Allied soldiers departed Japanese soil leaving around 115,000 US soldiers. Following the outbreak of hostilities in Korea in 1950, American forces in the region grew quickly, and by the time that the San Francisco Peace Treaty went into effect in April 1952, 260,000 soldiers were stationed across Japan as thousands more transited on their way to and from the front line in Korea (Takemae 2003: 126).

In addition to thousands of US military and civilian personnel, the Supreme Commander for the Allied Powers (SCAP) also provided for increasing numbers of military dependents – spouses and children accompanying servicemen. In 1946, the US government officially sanctioned family members to join military personnel stationed abroad (Alvah 2007: 2). Within the first six months of the occupation, 700 families joined soldiers in Japan; by 1950 that number had increased to 14,800 (Takemae 2002: 75; General Headquarters (GHQ), Supreme Commander for the Allied Powers and Far East Command (FECOM) 1950: 107).

The presence of service members' families played an important role in the expansion of the American empire overseas. Military wives and children, in unofficial capacities, facilitated occupation efforts and participated in Cold War international relations through their interactions with local residents. This 'unofficial' arm of the US military fostered international co-operation and cultural exchanges and, just as importantly, showed the supposed benefits of American life to the Japanese people and the wider Cold War world (Alvah 2007: 39–40). Dependents also posed a challenge: occupation authorities had to protect the health, morale and bodies of American soldiers as well as American women and children.

The building of an occupation biosphere was in part a project to provide military forces and families with a comfortable, sanitary and familiar way of life. Such a way of life was built on a system of differentiation steeped in racial anxiety. It is important here to understand the racialized foundation of the US military's occupation of Japan. In 1945, the US military was still segregated, and while Black personnel enjoyed many of the same privileges as their white counterparts, they generally had to live and work in their own enclaves (Green 2010). Moreover, they still faced discrimination by white soldiers and much harsher treatment from white officers. The US military was also trying to re-define where Japanese subjects fitted into its segregated racial global order while dismantling a former multi-ethnic Japanese empire (Shibusawa 2006). Military officials believed that each individual had a 'proper national territory', and forcibly sorted and moved people according to the military's understanding of their race or origin (Watt 2009). The United States was a crucial partner in the forced displacement of former Korean and Chinese imperial subjects to actualize the belief that Japan was an ethnically homogenous nation. This is not to say that the US military created the idea of Japanese 'purity' or uniqueness, but rather that the US military, Japanese government, humanitarian aid groups, intellectuals and ordinary people colluded to make that idea a reality (Oguma 2002; Morris-Suzuki 2007). These histories collectively show the complex, transnational, gendered and racialized nature of occupied spaces during the process of decolonization in Asia following the end of the Second World War.

In occupied Japan, Okinawa and Korea, the US military attempted to consolidate its own biosphere. This was to be a space that met the ideal hygienic and environmental standards that experts felt were attuned to the bodies of US military personnel. It also produced categories of difference that appeared to be based on medical science. When justifying the use of hydroponic technology, for example, the military used the language and science of hygiene

to hierarchically differentiate between non-American (unhygienic) and American (hygienic), and between 'non-white' and 'white'. While race was crucial to the development of hydroponic technology, the language of hygienic soil or space – or lack thereof – was a more palatable alternative to establish a hierarchical order while straddling the divide between occupier and saviour, or hegemon and ally.

The US military claimed the authority of scientific 'truth' to (re-)code occupied space as unhygienic. Their (re-)coding of space highlighted the supposed backward nature of both Japanese space and Japanese people. However, Japanese hygienists and officials themselves had a historical understanding of the risk of human faeces as a vector for disease. While night soil had been a valuable resource from the late Tokugawa period (1603–1867) through to the twentieth century, people were aware that unprocessed night soil could transmit gastrointestinal parasites between humans, and that a breakdown in collection services could lead to a foul-smelling Petri dish for diseases such as dysentery or cholera (Hoshino 2008: 194). Local governments had developed an infrastructure to manage this valuable resource. In the early 1900s, Tokyo Police Department regulations included how night soil was to be handled: it could only be transported in sealed buckets, and the containers could not be left out under the heat of the sun (*Kindai toshi no eisei kankyō, Tōkyō-hen* 2009).

Against the benchmark of a post-Second World War urban middle-class white ideal, Japanese agricultural practices were deemed backward and therefore a sign of medical and even civilizational deficiency. Occupied space thus also functioned as an abstraction through which to make a case for US stewardship. The rhetoric of deficiency, in hygiene and democracy, drew on a colonial logic of space: the military's role was to rehabilitate the unhygienic geography and people of their newly acquired territory. The maintenance of those spatial and racial categories relied on fear of medical threats and anxieties of white vulnerability vis-à-vis occupied people. This threat allowed the US military to gather considerable resources needed to construct cutting-edge technologies, such as hydroponic farms.

Hydroponics in the US military

Making Japanese soil safe to provide food for occupying forces and their families required creating a new sealed environment. In 1946, the General Headquarters

(GHQ) appropriated the former Imperial Air Force base in Chōfu-shi near Tokyo, and a similar area near Ōtsu-shi near Kyoto, to establish hydroponic farming depots. The soilless farms – 55 acres (22.25 hectares) and 25 acres (10.11 hectares) respectively – supplied personnel and families with ‘morale-building’ tomatoes, lettuce, radishes, Chinese cabbage, cucumbers, onions and spinach. By 1951, these hydroponic farming depots produced almost 5 million pounds (2,267,962 kilograms) of ‘salad-type vegetables’ for 153,000 individuals (Edwards 1949a; Edwards 1949b; Boardman 1962).

In its most simple form, hydroponic farming is the growing of plants without soil. Records of early civilizations in Mesopotamia, Mesoamerica, northeast Asia and North Africa describe the growing of plants in this fashion. Over the subsequent centuries, experts established that plants would grow in insoluble aggregates, such as gravel, when provided with appropriate chemical solutions (Hershey 1991). By the twentieth century, the focus on industrialized farming techniques stimulated interest in large-scale commercial applications of soilless agriculture. The US greenhouse industry was particularly interested in the possibilities of this new ‘nutriculture’. Nutriculture, a portmanteau word combining ‘nutrient’ and ‘culture’, refers to a hydroponic process whereby plants are grown in a sterilized neutral medium, such as gravel, and irrigated with solutions of nutrient chemicals. Between 1925 and 1935, the hydroponic industry struggled with high costs and long-term difficulties with soil structure, fertility and pests. While experts tried to scale laboratory techniques of nutriculture to meet an industrial farm’s needs, because of its chemical-, labour- and capital-intensive characteristics large-scale hydroponic farming remained out of reach (Resh 2013: 2).

One of the first economically viable applications was undertaken by William Frederick Gericke at the University of California during the 1930s. He named his backyard system of liquid-filled tar-coated redwood tanks ‘hydroponics’ – derived from the two Greek words *hydro* (water) and *ponos* (labour) (Resh 2013: 1–2). Large corporations took note. In 1938, Pan American Airways contracted Gericke to help build a hydroponic garden on its waypoint in the North Pacific, Wake Island’s Airways Inn. The sandy atoll suffered from a lack of arable soil and water. Greike’s controlled environment in tank gardens required approximately 10 per cent of the water needed for traditional soil farming and none of the soil. The gardens provided such a surplus of endives they began air freighting salad leaves to Midway Island (Taylor 1939: 14–15).

The Army Air Force (AAF) was also experimenting with nutriculture crops in the 1940s. It recognized the negative effect that a diet of canned rations and

dehydrated vegetables had on the morale and health of soldiers. The AAF was particularly interested in how fresh vegetables could influence the healing of injured soldiers. One of the first large-scale military nutriculture stations was built near the Pratt General Hospital in Coral Gables, Florida, as a part of the AAF rehabilitation programme (Quartermaster General 1946). For the military, salads were tied to the mental and physical wellbeing of soldiers, to the faster return of injured personnel to the front, and to the improved performance of the soldier on the battlefield.

The army's hydroponics manual states that independent farming stations were feasible only for troops at small, remote installations with limited arable land and supply prospects. The Pacific theatre fit these conditions. Supplying troops at installations on distant islands with fresh produce was challenging, if not impossible. The military was not enthusiastic about local soil-grown vegetables. In part, this was due to the acidic nature of soil on coral atolls, which made it difficult to successfully cultivate crops. The military also assumed that soil in these areas was 'infected with amoeba'. If any vegetables were, against all odds, grown and harvested, the army required that they be cooked (Boardman 1962: 3; Allied Operational and Occupation Headquarters 1945). The AAF proposed the establishment of hydroponic gardens alongside forces' isolated long-term installations as a solution. Researchers thought that a hydroponic farming process could guarantee an hygienic end product (War Department 1946). The AAF, however, found it difficult to find a hydroponic method that was efficient, cheap and reliable.

The initial method of hydroponics used sealed beds in which plants were suspended in a mechanically aerated nutrient solution. This 'water culture' was time-consuming and materially intensive. Moreover, the mechanics of circulating the solution proved expensive. Maintaining the balance of oxygen and nutrients also required the constant attention of well-trained personnel. The AAF thus found it unsuitable for their purposes. The second experimental method relied on a fine mineral aggregate. This 'sand culture' was relatively easy to set up, as beds did not need to be waterproof and plants could support themselves through their own root structure, unlike the previous water-culture. The main drawback of this method was that it required skilled labour to maintain uniform irrigation. Uneven watering led to nutrient-starved plants, which adversely affected yield and quality of produce. In addition, the leftover water and chemicals that plants did not absorb were wasted as they filtered into the ground. This was unacceptable for the military's needs.

The AAF eventually decided upon a third technique – the sub-irrigation method. In this process, beds were arranged in a simple terrace system. The first tier was flooded from an above-ground tank. When the nutrient solution reached the required level, a valve allowed the solution to drain into the next section where the process was repeated. After the lowest tier, the solution drained into a sump-tank (a below-ground, gravity-fed tank) where it was analysed by a technician, replenished with the necessary balance of water and chemicals, and then pumped back to the first tank.

The sub-irrigation method used fewer labour hours, produced relatively more uniform results and required fewer high-skilled supervisors. Moreover, as a closed system it was the most economically efficient at providing seedlings with nutrient chemicals (Boardman 1962). The waterproof beds facilitated a uniform spread of fertilizer and prevented nutrients seeping into the surrounding soil. The main nutrient loss was through evaporation. In addition, army medical officers believed that this method eliminated the danger of soil-borne diseases and provided ‘truly’ hygienic and ‘chemically pure’ vegetables (Pitt 1950).

A 1945 ‘Survey of Requirements for Hydroponics in Pacific Ocean Areas and Far East’ traces the initial spread of soilless farming through the military. The first overseas nutriculture facility was established at Ascension Island in the Atlantic. It cost \$44,000 to build this 1-acre (4,046 square metres) facility. In its first year, the garden produced 94,000 pounds (42,638 kilograms) of salad vegetables. While this seems high, year-round farming, higher plant density, specifically bred seed varieties, and the efficient use of fertilizer allowed for significant crop yields. With added protection from adverse temperatures and weather conditions, farms could see ‘4–10 times increase in yields obtained by soilless culture outdoors over conventional soil-grown conditions’ (Resh 2013: 6).

The next similar-sized installation was built at Iwo Jima in the Pacific for \$11,250. In the same year, the AAF also organized multiple survey trips by teams of military officers and civilian scientists across Africa, the Caribbean, as well as further into the Pacific. Small-scale stations were built in British Guiana (Atkinson Field) and on Coconut Island (or Moku o Lo‘e), near O‘ahu in Hawai‘i. By 1946, the military had come to recognize the potential for the technology across all theatres. Because of decreased appropriations and manpower, however, that same year the AAF turned over responsibility to the Quartermaster General (QMG) (Quartermaster General 1947). Their experiment had become a crucial project for the US military.

Building the biowall: public hygiene, governmentality and imperialism

The prohibitive costs of construction made opening new gardens a difficult proposition. The decision to create two of the largest hydroponic facilities in the world in occupied Japan was a radical undertaking – even if the army valued fresh vegetables for their effect on the minds and bodies of American soldiers. Their construction was facilitated by the US military's perspective of a hygienically deficient Japan as well as the intertwined histories of empire and preventive healthcare.

The US military's use of hygiene is part of a story of state expansion into private realms of diet, medicine, water and housing that accelerated in the nineteenth and twentieth centuries. It is also a story of class conflict and imperialism, as violent and coercive medical practices carried out in the name of modern health cut across national boundaries. As European governments, physicians, lawyers, clergy and other elites struggled to manage 'the barbarian within', colonial administrations provided country-sized laboratories for studying local populations, poverty and disease (Stoler 1995). Colonial elites used the perception of biomedical deficiencies to differentiate the 'West' from the 'Orient'. In doing so, they perceived Indigenous peoples and lands as diseased objects and pathogenic environments which in turn justified their use of coercive techniques (Arnold 1993). In many of the places that are discussed in other chapters in this volume – from British India to the colonial Philippines – Europeans and Americans embraced the idea that local people were inherently lacking when compared with Western-defined standards of health, and that white bodies were at greater risk in supposedly diseased colonial environments.

Entrenched beliefs in racial and geographical pathologies were compounded by microbiological principles. The laboratory revolution and advances in medical microscope technology at the turn of the nineteenth century brought about a sea-change in the understanding of the relationship between disease, environment and human bodies. The ability to visually prove the existence of disease-causing agents dismantled the idea of medically-deficient environs, while re-conceptualizing people as carriers of disease (Cunningham and Williams 1992; Lei 2014). In British and American colonies, the rise in germ theory strengthened the assumption that 'native' bodies were reservoirs of dirt and disease, and facilitated more rigorous surveillance as well as control of personal conduct and social interaction with local people to limit disease transmission (Harrison 1999: 22; Anderson 2006: 75). Under the biomedical

gaze, people – particularly poor and colonized people – did not appear as recognizable individuals or families, but as categories and objects in need of Western intervention. Medicine was thus a tool of imperialism (Lei 2010: 40–3).

The US military's understanding of occupied space drew on the experience of other colonial empires and its own colonization of the Philippines. In 1899, the Ninth US Cavalry's Captain George W. Read translated Ferdinand Burot and Maximilien Albert Legrand's *Les Troupes Coloniales* (1897) for the International Military Series by Lieutenant-Colonel Arthur L. Wagner, a prominent military instructor and scholar. 'Anything good or bad for a French soldier,' Read argued, 'will be beneficial or injurious to an American soldier serving under like conditions' (Burot and Legrand 1899). Publication of *The Hygiene of the Soldier in the Tropics* (1899) reflected a recognition of the heavy losses the environment and lack of hygiene wrought on camps behind the front lines during the Spanish-American War (1898). The hygiene manual drew on miasma theory – the outdated medical theory that held that diseases spread through noxious 'bad air' – warning of the febrile conditions of humid places, for 'in the tropics the soldier is always in campaign; if not against the enemy, at least against the climate'. At the same time, it explained that the soil was a 'receptacle of germs' which provoked endemic diseases such as paludism (malaria) (Burot and Legrand 1899: 7–9).

Colonial officials incorporated new germ theory to articulate the dangers posed by Filipino spaces and bodies. US sanitary officers in the colonial Philippines believed that the tropical environment was covered with a 'thin film of germs' in need of disinfection (Anderson 1995: 641). Much of this, white American health officers argued, was a result of local people's 'reckless' defecation. They warned Filipinos that they were poisoning the environment and thus posed a danger to American bodies. Filipino use of night soil as a fertilizer to increase crop yields had contaminated soil with 'mixed cultures of amoebae, cholera bacilli and other pathogens' (Anderson 1995: 661–3).

To American commanders in the Pacific theatre during the Second World War, Indigenous people were 'seedbeds of disease' and the environment ripe for a variety of fungal and parasitic skin infections. Conscripted Pacific Island labourers were segregated from US military units, subjected to regular hygiene inspections, confined to their camps at night, and forcibly administered the anti-malarial Atebrine. Engineers used dynamite or torpedoes to turn turgid rivulets into flowing waterways (to flush out malaria vectors) and local labour units liberally applied diesel or insecticides, such as DDT, to standing water. The military even introduced invasive minnows to better regulate mosquito reproduction (Bennett 2009: 50–60). The US military manipulated 'native'

bodies with pharmaceuticals and remade the wartime environment with chemicals, explosives and manual labour, creating areas that they imagined as more suitable for American soldiers' bodies.

The experience of the US military while colonizing the Philippines and in wartime theatres in the Pacific formed the basis of post-Second World War occupations in the Asia-Pacific region. Indeed, the US military began its occupation of Japan by regulating the germ ecology of the country. The occupiers secured borders, limiting the circulation of foreign pathogens, and managed or sterilized germs to build their hygienic empire. The occupation authorities' 'biowall' – that is, the use of bureaucratic, physical and financial mechanisms to control an ecological system and prevent the movement of particular organisms – was meant to quarantine pathogens and pests deemed detrimental to ecological systems. This bio-wall stretched to control the human and environmental vectors of parasites, and to prevent the spread of communicable and infectious diseases.

This is not to imply that Japan was in fact 'unhygienic' or behind in the race for greater control over sanitation of both bodies and environments. As Susan Burns has shown, linking individual health with public hygiene to create a national body was crucial to the Meiji state's project of building a modern nation-state (Burns 2000: 18). By the 1920s, Japan was using globally accepted biomedical technologies of public health administration as well as vaccines and nutritional science. During wartime it also had a sophisticated system of customs and quarantine to isolate foreign agricultural products. Yet to European and American powers, Japan was still considered a deficient non-white 'other'. As John Dower put it, Japan was perhaps 'the cleverest of the pupils of the West', but nevertheless a pupil (Dower 1993: 148).

The process of constructing an ideal occupation biosphere led to conflicting actions between military branches and eventually proved detrimental to its integrity. For example, the QMG had a mandate to provide forces with nutritious, familiar and hygienic meals. While the War Department had prohibited most imports, the QMG used a loophole that allowed the Subsistence Branch of the Quartermaster Corps to bring what the forces needed to eat directly from the United States, often without inspection at the port of arrival. Wartime procurement depots across the United States funnelled meat, fruit, seeds and plants to a central depot in San Francisco where goods were consolidated and re-routed to the Pacific (Hoffmann 1943: 27). A 1951 GHQ memorandum assessed that the largest quantity of prohibited plants in fact likely came into Japan through the military supply network (Higuchi 2010: 52). This systematic importation of foreign seeds and plants, particularly species that were common to North America, posed a

threat to the local ecology while being integral to the construction of the occupation authorities' ideal biosphere. In other words, the US military's own efforts ultimately punched holes in its biowall. Shipments of grain and seeds provided a medium through which foreign weeds and agricultural pests filtered into Japan (Higuchi 2010: 55). In the process of building a biosphere that suited the occupiers, the US military unintentionally helped introduce invasive species, proving that the imagined hermetic seal was not so airtight after all.

Contaminated Japan: a brief history of night soil

The US military was worried not only about foreign biological threats entering its occupied territory, but also about the hazards already *within* that territory. This made it difficult, if not impossible, to source provisions locally. US medical officers considered the very Japanese soil to be inimical to the health of American forces (Office of the Chief Signal Officer 1952; Allied Operational and Occupation Headquarters 1945). Medical officers warned that the soil was 'contaminated', and that locally grown uncooked vegetables were vectors for dangerous '... amoeba which cause[d] dysentery in humans who are not immunized' (Allied Occupation and Operational Headquarters 1946). American bodies were, in their view, not acclimatized to deal with local parasites, and soldiers and their dependents were repeatedly warned not to eat anything off base. Occupation authorities were particularly concerned with the local reliance on night soil. Medical officers held that produce grown in Japanese soil was highly unsanitary and especially unsuitable for raw consumption 'due to the age-old custom of utilizing human excreta as fertilizer' (Quartermaster General 1947). They were worried that contaminants and parasites in the soil could seep into germinating seedlings, making them unsuitable for occupier consumption.

Ironically, pre-war Japanese farmers had been amongst the most intensive users of chemical fertilizer (Cohen 1949: 365). The wartime demand for nitrogen-based munitions, however, had diverted ammonia toward arms manufacturing (Tsutsui 2003: 301). Wartime scarcity of chemical nutrients forced farmers to demand increased excrement collection in urban areas. There is a long history in Japan of using treated human waste as fertilizer. Japanese experts and officials understood that unprocessed human excreta carried risks of spreading disease-causing pathogens and parasitic worms since the 1910s (Kim et al. 2014: 62–7; Kreitman 2018: 348). By the 1930s, human excrement was usually chemically treated or cured in a sealed container before it was transformed

into night soil and was safe for use on crops. Wartime pressures destroyed this infrastructure. Fluctuations in the price of night soil and lower wages may have encouraged carriers to dispose of raw waste illicitly into bodies of water or cropland, thus contaminating produce. At the same time, the rationing of fuel and labour shortages drove many commercial collectors out of business. With cured night soil unavailable desperate farmers increasingly used raw excrement to fertilize fields.

Soil for salads

In December 1945, the US Army completed a survey of the 'Pacific Ocean Area and Far East' to establish how to provide food for military forces in the area. Subsequently, officers stressed that local produce was not suitable for American consumption even after washing; only a thorough boiling could sterilize such produce. The survey, conducted by Lieutenant-Colonel E.W. Elliot, cautioned that soil in Japan, Korea, Okinawa and the Philippines was 'contaminated with an amoeba that causes dysentery in humans. This preclude[d] the use, in the raw state, of many vegetables such as lettuce' (Allied Operational and Occupation Headquarters 1945). When read in conjunction with medical officers' concern over the use of night soil, the implication is that there was something deficient about Japanese soil. In short, Japanese bodies were polluting the soil, making it unsafe for occupying forces. Thus, the soil's connection to Japanese bodies through the use of night soil cemented the image of an unhygienic Japanese landscape in the minds of the occupation forces.

The anxiety about Japanese dirt was not only a result of the use of night soil, however. While there is an argument to be made for naturally acquired passive immunity – Japanese people were immune to some local pathogens due to generations of environmentally acquired immunity – the military deemed that islands across the Pacific were suspect:

Much of the trouble stemmed from the nature of the soils found in the Pacific coral atolls. In other instances, the soil, although fertile, was highly infected and greens had to be cooked before being eaten, thereby robbing them of certain elements obtainable only in the raw state.

Lieutenant-Colonel P.W. Schubert 1944, cited in Boardman 1962: 3

This suggests that the US military had a broader racialized perception of a 'diseased east Asia' and 'infected Pacific'.

Figure 8.1 ‘The greenhouse section of the Hydroponic Farm at Chōfu, Japan; 20 June 1947. Courtesy of the US National Archives and Records Administration (SC-286153).

As a result, the military decided to grow hydroponic vegetables on an industrial scale. When the 8th Army finished building the hydroponic depot at Chōfu, it was the largest hydroponic facility in the world: ten 5-acre open-air plots and one greenhouse plot filled with eighty-seven 5 x 300-foot (1.5 x 91-metre) beds (Elliot 1949). The greenhouses themselves were a feat of modern architecture – they were two and a half times larger than any other in the world (see Figure 8.1). Most importantly, they produced ‘high quality’ vegetables that met army hygienic regulations. The US military was heavily invested in creating an ideal biosphere, complete with hygienic vegetables, for its personnel and their dependents.

The building of nutriculture gardens was a massive undertaking, requiring skilled technicians and a large capital investment. However, despite the expense, the occupying forces neither requisitioned local produce nor imported it from the United States. In addition to the issue of hygiene, a convergence of post-surrender economic and political factors made the installations possible. First, building nutriculture gardens served a political purpose, in that they helped avoid possible civil unrest. The US Army stressed that diverting any food away

from Japanese civilians and to Allied troops could lead to riots (Allied Operational and Occupation Headquarters 1945). Japanese food sources were limited, and the situation was exacerbated by the roughly 6 million returnees from the empire and the severing of food imports from former colonies. Indeed, the scarcity of food became a flashpoint for public dissent characterized by the May Day riots outside the Imperial Palace in 1946 (Dower 1999: 529). The QMG argued that building hydroponic depots lowered the potential burden on local food stocks, and thus avoided undesirable political consequences.

Secondly, the War Department prohibited the requisition of raw vegetables from the United States in 1946 because of the distance and time involved. In the mid-twentieth century, a ship to Tokyo could take around thirteen days from Seattle, and up to fifty-three days from Brooklyn via the Panama Canal (Van Staaveren 1994: 6). For most food that made its way to the shelves of a military commissary, a federally-funded military store providing discounted groceries and household goods such as canned foodstuffs and frozen meat, the journey was not a problem (Allied Operational and Occupation Headquarters 1946). Perishables, however, did not fare well. Even on refrigerated ships, almost half of all produce shipped to Japan spoiled before arrival (Quartermaster General 1947). Unable to sustain such losses, the War Department eliminated shipment of all 'salad-type vegetables' other than those that could be canned, frozen or dehydrated (Office of the Chief Signal Office 1952).

The QMG argued that they could produce vegetables such as tomatoes at 50 per cent of the cost of those imported from the United States. Using data from a small installation at Atkinson Field, British Guiana, however, their projections showed that even while accounting for a 30 per cent shipping spoilage and a 6 per cent export overhead, hydroponically-grown vegetables were three to five cents more expensive per pound (Quartermaster General 1947). A 1948 cost analysis memo found that vegetables 'produced nutriculturally' in 1947 cost \$901,837 for 2,391,382 pounds (1,084,713 kilograms). Commercially grown produce from the United States would have cost less than half of that provided it survived the journey (Quartermaster General 1948).

The QMG recognized that the major objection to the project was the cost of construction. The Chōfu plant alone came to ¥278,055,000 (Shigekazu 2011: 16–18) or \$5,561,100 million (at ¥50-to-\$1).³ They argued that this was not a factor, 'as it is recommended that materials and labor be furnished by the Japanese government' (Allied Operational and Occupation Headquarters 1945). Under the terms of surrender, the Japanese government was forced to bear the brunt of the occupation forces' total operating expenses. In 1946, around 30 per

cent of the Japanese government's regular budget was set aside for such 'war termination costs', while millions of Japanese families lacked homes (Dower 1999: 115). The QMG was able to leverage the US military's status as victor to lower, or even write off, construction costs. Occupied space as colonial space provided the money and '“elbow room” for experimentation' on a commercial scale (Prakash 1999: 46).

Nutrition, morale and spectacular technology

To justify expanded operations, the military used pre-war ideas of acceptable nutrition and the desirability of industrially produced commodities. The army's interpretation of the science of nutrition is key to understanding why the military went to such great lengths for raw vegetables. The use of produce within the army, as a part of preventive medicine, therapeutic procedure and as dietary requirements for all soldiers, has a history that pre-dates the First World War. Over time, nutritional scientists gradually moved away from a focus on calories and looked deeper into foods for 'hidden nutrients' (Levenstein 2003: 148). During the First World War, medical officers were able to isolate the compounds of vitamins A and C, thiamine, and other minerals, as well as link them to the health of the soldier (Department of the Army, Office of the Surgeon General 1976).

Advances proved important to the diets of soldiers. Mess halls and rations were important parts of the developing field of preventive medicine and were at the forefront of keeping soldiers in fighting condition. Inadequate intake of calcium and the water-soluble vitamins received from fruit and vegetables often resulted in weight loss. Slow clotting time, chronic fatigue, skin infections and oral conditions were all symptoms suggestive of soldiers' avitaminosis (chronic vitamin deficiency). Furthermore, beriberi and pellagra were amongst the fatal wartime conditions resulting from lack of adequate nutrition (Department of the Army, Office of the Surgeon General 1976). During the Second World War, this was solved by issuing multivitamin tablets when supply was available. Fresh produce, however, was preferable, more common and cheaper. For the military, sufficient consumption of vegetables, as a vehicle for vitamins, was critical to the effective operation of the armed forces.

The QMG experimented with industrial techniques of dehydrating, flash freezing and canning. Some of the resulting forms were psychologically, if not literally, unpalatable. Officers often received complaints about flavours and

forms from soldiers coming from the front line (Quartermaster General 1947). Army nutritionists had decided that the calorie-dense, pre-combat C Ration was the most effective meal for fighting men. Unfortunately, servicemen criticized its monotonous taste. The complete food-for-a-day Field Ration C was originally limited to three canned main meals: English-style stew, meat-and-vegetable hash, and pork and beans. It also included a 'D' chocolate-and-wafer-bar, crackers, hard candy, dextrose (sugar/energy) pills, as well as soluble coffee, cocoa and lemonade mixes. Sustained criticism of the diet led to revisions, however. The 1944 C Ration included ten meat varieties: meat and beans; meat-and-vegetable stew; meat and spaghetti; ham, egg and potato; meat and noodles; pork and rice; frankfurters and beans; pork and beans; ham and lima beans; and chicken and vegetables. The new pack was also supplemented with biscuits, compressed premixed cereal, candy-coated peanuts or raisins, soluble coffee, sugar, lemon- or orange-juice powder, hard candies, jam, cocoa beverage powder and caramels.

One item offered a burst of palate-cleansing diversity: a fresh salad of lettuce, cucumbers and radishes. The Subsistence Section of the Quartermaster General believed that the psychological effect of vegetables was just as important as the physiological benefits of the vitamins they contained. They argued that fresh fruit and vegetables improved troop morale – lettuce and tomatoes alleviated field ration-induced palate fatigue and minimized 'gripes' (Quartermaster General 1947). The stabilization of troop morale was paramount both during and after the end of hostilities, as military personnel settled into a foreign environment.

Diet diversity was balanced with standardization and routine. The armed forces attempted to portray the ideal face of 'America' by 'creating the illusion that the soldier [was] middle class, clean, well bred, and well fed' (Babic 2017: 163–4). There were strict requirements to adhere to: haircut, weight and dress standards (such as a fitted, starched-crisp uniform) were important components. Consequently, diet while deployed, as well as goods sold at commissaries, served as indicators of class status and social mobility. Like the soldiers' uniforms, the foods that they consumed acted as tangible and visible aspects of their American military identity.

The US military standardized diets to provide familiarity to soldiers spread across many theatres. The master menu for messes was created and sent from Washington, DC. Though these menus were meant to allow for some degree of flexibility, particularly when using fresh produce, they skewed heavily towards Anglo-Saxon and European foodways. Recipes from the Quartermaster Food and Container Institute for the Armed Forces in 1946 listed soups such as

borscht, corn chowder and cream of potato, as well as meat dishes such as spaghetti with meatballs, corned beef with macaroni, baked luncheon meat with mustard sauce, and various sausage dishes. There was also one recipe for a 'chop suey mixture' served with rice (Office of the Quartermaster Military Planning Division 1946).

The demographics of the armed forces during the war were more diverse than this menu implied. Out of 16.1 million personnel, around 1 million were Black servicemen, including a number of Puerto Ricans and Afro-Cubans miscategorized as African Americans (Green 2010: 11; Eschbach and Rivas-Rodriguez 2014: xii), while some 60,000 Puerto Ricans (Collins 2016) and over 33,000 Japanese Americans (Fujitani 2011, 19) enlisted. Around 21,000 Native Americans (Bernstein 1999: 40), 16,000 Filipino Americans from California (US Congress 2015; Schmidt 1982: 2) and 12,000 Chinese Americans also served in the armed forces (Wong 2009: 1). The label of 'white' also hides the complexity of that category. Around 1 million Polish Americans (Haiman 1946: 35), more than 1 million Italian Americans (LaGumina 2002, 92), over 500,000 Jewish Americans (Moore 2004: 9), and between 400 and 500 Latinx men and women, mainly of Mexican descent and considered 'white' by the military at the time, were part of the military (Eschbach and Rivas-Rodriguez 2014: xix). Despite the complex demographic nature of the armed forces, the QMG generally did not include their foodways or dietary restrictions while planning rations or diets for men at war. When military planners and administrators thought of the armed forces more broadly, the American soldier was synonymous with a white, middle-class, Protestant soldier of Anglo-Saxon descent. During and immediately following the war, those who did not fit into this rubric were expected to conform to that ideal and, in this case, diet.

During the occupation of Japan, the War Department ordered that central messes serve 'A Rations' – meals prepared using only fresh, refrigerated or frozen foods (Ishoy 1947). Cooks were supposed to provide familiar meals for soldiers and their families no matter where they were. The 'good American menus from the Office of the Quartermaster General [were] ready with meals of meat mashed potatoes vegetables and pie in the lands hot with Arab cousscouss [*sic*] and Indian curry' (Hoffmann 1943: 50). The implication is clear – while soldiers may have experimented with or even enjoyed local foods, the military as an institution rejected non-conforming dishes. Eating meat, mashed potatoes, vegetables and pie was a tool of military command to produce particular physiological or psychological benefits. At the same time, it was a tool to enforce an identity as a member, or dependent, of the American military (Babic 2017: 163). For many

working-class and non-white service personnel it was their first taste of the life they were supposed to lead as Americans.

The QMG also emphasized that salads contained beneficial nutrients and were the answer to morale issues with their 'taste of home'. Colonel C.E. Dovell, a surgeon in the 8th Army, noted that hydroponically farmed 'produce was "tasty nutritious, fresh, and highly acceptable by hospital patients"'. Moreover, the vegetables provided 'additional vitamins and minerals, and greatly increase[d] the palatability of the menu, with a resulting increase in efficiency and morale of the troops'. Colonel Dovell also alluded to the emotional effect of salads, concluding that 'the continuance of this nutriculture station is highly desirable in promoting and maintaining the health, morale, and well-being of occupational personnel, particularly troops and patients' (Edwards 1950). The psychological and physiological effects of fresh produce were crucial to the upkeep of soldiers in this new corner of the American empire.

There was also a psychological effect of hydroponic technology itself. David F. Noble argues that the military evaluated the efficacy of the technology it developed in three ways: performance, central command and modern approach. Noble (1998: 346) suggests that the military's interest in the 'modern' was a fixation with developing and using new technologies. The *need* to use hydroponic technology came not simply from nutritional or economic concerns, but also from a desire to use new, more modern, technologies that inspired wonder – a 'technological sublime' – to prove the superiority of the nation. This resonates with David E. Nye's examination of monumental technology. Nye argues (1994: 37–43) that the emotional reaction to an awe-inspiring sight of man transcending nature on a massive scale was a collectivizing experience. Through hydroponics, it was not only the US military that conquered Japanese space, but America writ large.

The spectacle of modern technology played a role in the use of nutriculture. This is particularly evident in the way that hydroponic farming was represented in the mass media. The army supplied news outlets with US Army Signal Corps pictures and kept track of reports. Domestic US press releases, reliant on access provided by the Signal Corps, stressed the salad's diversification of personnel's diet and its effects on troop happiness (Office of the Chief Signal Officer 1952). *The New York Herald Tribune*, *The New York Times* and the *Washington News* all ran articles on hydroponics in 1947.

CBS also made a brief announcement via radio in both the New York and Washington, DC areas (Schlabach 1947). Photographs, radio broadcasts and news articles were an integral part of educating the public about the US mission

Figure 8.2 Article from the *New York Herald Tribune* entitled 'Hydroponic Gardens Supply Army Bases with Food', August 1947. Courtesy of the US National Archives and Records Administration (RG 92, BX 2, FL 25).

during the occupation of Japan. They were also avenues through which the military could enjoy the public to connect with and celebrate the United States' technological ingenuity.

In November 1947, an American bi-monthly magazine, *Popular Science*, published an article entitled 'Multitude Fed Without Soil'. It opened its celebration of hydroponics in occupied Japan with a quote from the Gospel of Matthew: 'And when it was evening, His disciples came to Him, saying: This is a desert place ... send the multitude away ... But Jesus said unto them: They need not

depart, give them to eat.' Using this religious simile, the magazine emphasized the spectacular aspect of the US Army's feat while simultaneously rendering Japan a barren land. The article boasted that a great multitude of occupation forces would be able to eat 'prime' celery with roots that had 'never been near the earth'. The author did recognize the expensive nature of the technology and the fact that even the army had strict limitations. The army usually only approved hydroponic technology for locations with no arable soil, or 'where the soil, through the use of human fertilizer (such as Japan and China), is unfit for the growth of vegetables that are eaten raw' (*Popular Science* 1947). Using cutting-edge technology, the military had managed to 'overcome' the nature of Japanese soil, an achievement the magazine suggests was of biblical proportions.

In Japanese, the English-language *Nippon Times* published an article on 6 February 1947 focused on the forward-looking nature of the technology. The 'super farm of steel, concrete and chemicals' was juxtaposed with Japanese farmers' ageold [*sic*] methods'. The army's technology was to 'open a new door for the future' of agriculture to a 'new era of scientific farming'. It reduced 'soil borne diseases' and ensured that there were 'no weeds to contend with'. As far as the newspaper was concerned, this technology improved upon nature.

The farming depots were themselves sites of spectacle. At the Chōfu centre's opening in March 1947, Lieutenant-Colonel Elliot, head of the nutriculture project, feted Prince Takamatsu (brother of Hirohito), Mrs Douglas MacArthur, Major General C.E. Byers and other local notables. The US military also organized tours for servicemen and foreign nationals. The GHQ Information Center ran regular tours that visited Japanese porcelain and glass factories, movie studios and hydroponic farms (*Pacific Stars and Stripes* 1950). In 1956, the Argentinian ambassador Carlos A. Quiros and a delegation from the Royal Thai Air Force including Air-Vice Marshal Kamol Thejatunga separately viewed portable growing beds and sample crops. They also toured the packing facilities and ice plant.

The US military was, in a sense, 'staging science' to reinforce the hierarchy of power (Prakash 1999: 34). The military used public demonstrations of the hydroponic process to evoke a sense of wonder at the seemingly magical act of producing vegetables without soil. Simultaneously, soilless farming was a powerful weapon to demonstrate the military's mastery over Japanese space. This proved the ability of American technology to overcome the so-called backward occupied environment. The army positioned hydroponics as clean and contained, an answer to the messiness of the occupied space and its threatening topographies and microbes. Moreover, it took plant domestication to enclosed,

Figure 8.3 'Lt Col. Elliot explains to Hirohito's brother, Prince Takamatsu (far right), and the emperor's first cousin Prince Takida [*sic*] (third from right), and other important Japanese, the functions of the nutriculture laboratories at Chōfu', 20 March 1947. Courtesy of the US National Archives and Records Administration (SC-284369).

Figure 8.4 'Major Ross W. Crossley explains the details of the vegetable display to Carlos A. Quiros, Argentinian Ambassador to Japan', 3 July 1956. Courtesy of the US National Archives and Records Administration (SC-481538).

stacked readable levels, providing a 'legible grid that could be easily grasped at a glance and that could be repeated in every direction, ad infinitum' (Scott 1998: 108).

This technological presentation courted American soldiers, the American and Japanese press, and foreign visitors. It functioned as a means to impress upon an audience the benefits of the US presence. For the American soldier this was a monument to national ingenuity and the overcoming of nature itself. For the Japanese journalist, it was a means of liberation from the Malthusian trap of limited soil fertility. And for foreign militaries, it was a technology to perhaps use in their own military bases.

Conclusion

In December 1948, seemingly without discussion, the QMG authorized soil farming around hydroponic facilities. The area tilled only increased during the Korean War (Edwards 1949a). Since the Chōfu airstrip had become overgrown during the war, medical officers believed its soil was less likely to be contaminated by human waste. Just like that, Japanese soil had become trustworthy. It is unclear if the soil had been sterilized by trustworthy chemicals. However, the pressures of increased personnel in the theatre, a war on the Korean Peninsula and a changing relationship with Japan caused a shift in operations.

In the end, only eighty out of the combined 300 acres (121 hectares) at both farms were used for hydroponic technology. An increasing portion was cultivated using chemical fertilizer and powered equipment. Its output soon dwarfed the nutriculture project. Despite these developments, as late as January 1952, Brigadier General W.E. Shambora, chief surgeon of the Far East Command stated: 'In a country like Japan or Korea, where human excreta is used as a fertilizer, it is unsafe to eat uncooked vegetables, so that hydroponic products are of particular value' (Shambora 1952). Early in 1953, production of vegetables for the armed forces shifted to locally produced, conventionally soil-farmed crops. The reconstruction of Japan's chemical fertilizer industry made low-cost vegetables that met the military's idea of hygiene widely available. The military shuttered the Ōtsu farm the same year and returned the Chōfu airstrip to Japan in 1960 (Boardman 1962).

Food provisioning through environmental engineering was central to the construction of an American biosphere. However, while this chapter has traced the history of hydroponics, it is not a history of technology, but rather an

exploration of how new technologies are interpreted and integrated into social spaces (Nye 1994: xv). The use of hydroponic technology in the occupied space of Japan was founded on colonial ideas of race and racial hygiene. It was made possible by leveraging the status of the US-military-as-conqueror and its expanding military power. Through its position as occupier, the United States was able to force the Japanese government to bear much of the radical project's costs. Thus, the United States was able to appropriate the land itself and capitalize on labour costs depressed by war and defeat.

Food is not simply the nutrients that transform the energy of an ecosystem into the calories that power the human community. Food is also a bundle of ideas. A complicated cultural construct, how and what we choose to eat is intimately intertwined with what we think about food, its relationship with our bodies, our relationships with others, and our relationship with the natural world (Cronon 1990: 1124). Thus, a seemingly innocuous phrase such as 'hygienic vegetables' is not a neutral, objective measure of the contents of a dinner plate. Its definition is deeply subjective and influenced by beliefs that discriminate between people and spaces. The effect of this phrase's use was to render agricultural practices and eating habits of populations politically legible, classifiable and rejectable. The phrase was one of the tools that allowed authorities to supervise the conduct of people and render populations modern or 'unmodern'. US officers' mix of cultural presumptions about hygiene and data on plant growth were tangible enough to mould facts (Mitchell 2002: 80–3) and reduce the very environment down to one word: unhygienic. The development of the gardens at Chōfu and Ōtsu thus sits at an intersection between several aspects of occupied space: segregated space, colonial space and spectacular, or performative, space. These were tied together by the imperial dynamics of the growing US military base system – all through the supply of salad vegetables.

Notes

- 1 The author would like to thank Jordan Sand and Chelsea Hudson for the invaluable feedback that they provided on earlier versions of this chapter. Research was in part funded by the Japan Foundation Doctoral Fellowship.
- 2 This is the conventional periodization of the occupation of Japan led by the United States. Though the ability to make sovereign decisions was returned to Japanese authorities on 28 April 1952, the physical presence, and I would argue the spaces of occupation, remain. Formalized through Status of Force Agreements (SOFA),

military bases, uneven power hierarchies and US military installations still exist on the main islands of Japan as well as on Okinawa today – a topic that is explored by Sayaka Sakuma in this volume.

- 3 When the occupation forces landed, they adopted a ¥15-to-\$1 conversion rate which was then transformed into a complicated system of multiple exchange rates. What followed was an increasingly volatile exchange rate that was devalued on multiple occasions. In 1946, the rate changed to ¥50-to-\$1, in 1948, it was ¥270-to-\$1, and finally, in 1949, the rate became ¥360-to-\$1 and remained there under the Bretton Woods System until 1971 (Takagi 2015: 5–7).

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