

Farming the Desert: Agriculture in the World War II–Era Japanese-American Relocation Centers¹

KARL LILLQUIST

In 1942 over 110,000 Japanese Americans were evacuated from the West Coast to ten inland, barbed wire–enclosed relocation centers in the name of national security. Agriculture was a key component of the eight arid to semi-arid centers located in the western United States. Each center’s agricultural program included produce for human consumption, feed crops, and livestock. Some centers also grew seed, ornamental, and war crops. Evacuees raised and consumed five types of livestock and sixty-one produce varieties, including many traditional foods. Seasonal surpluses were preserved, shipped to other centers, or sold on the open market. Short growing seasons, poor soils, initially undeveloped lands, pests, equipment shortages, and labor issues hampered operations. However, imprisoned evacuee farmers proved that diverse agricultural programs could succeed in the harsh settings primarily because of labor-intensive farming methods, ingenuity, and the large markets provided by the centers. These agricultural programs played major roles in feeding, providing meaningful employment, and preparing evacuees for life outside the centers, and readied lands for post-war “homesteaders.”

UNITED STATES’ AGRICULTURE HAS BENEFITTED greatly from labor of the imprisoned as well as that of ethnic and racial minorities. The use of inmate labor on US prison farms began in earnest in the years following

KARL LILLQUIST is a professor of geography and co-director of the resource management graduate program at Central Washington University. He teaches courses in physical geography, mountain environments, arid lands, and geographic techniques. His research focuses on historic and prehistoric landscapes of western North America and includes articles published in *Arctic, Antarctic, and Alpine Research* as well as *Western North American Naturalist* and *Physical Geography*.

the Civil War. With the establishment of these farms, inmates and managers learned appropriate methods to raise crops and livestock in new settings, often with racial or ethnic minority-dominated work forces not previously involved in agriculture.²

Prison farm agriculture has ranged from being subsistence- to commodity-based. For example, agriculture at the Idaho Penitentiary included vegetables, fruits, berries, grapes, and livestock, primarily for consumption within the prison. When produce was especially abundant, excesses were dried, canned, and otherwise stored. As a result, the Idaho Penitentiary was as much as 50 percent self-sufficient during its years of operation. Conversely, Parchman Farms and Angola State Penitentiary prisoners from the Delta Region of Mississippi and Louisiana primarily raised cotton and sugarcane for sale to the outside world. Both southern prison farm operations were managed to maximize profits—Parchman Farms operated nearly one million dollars in the black during World War II and was profitable as recently as the early 1950s.³

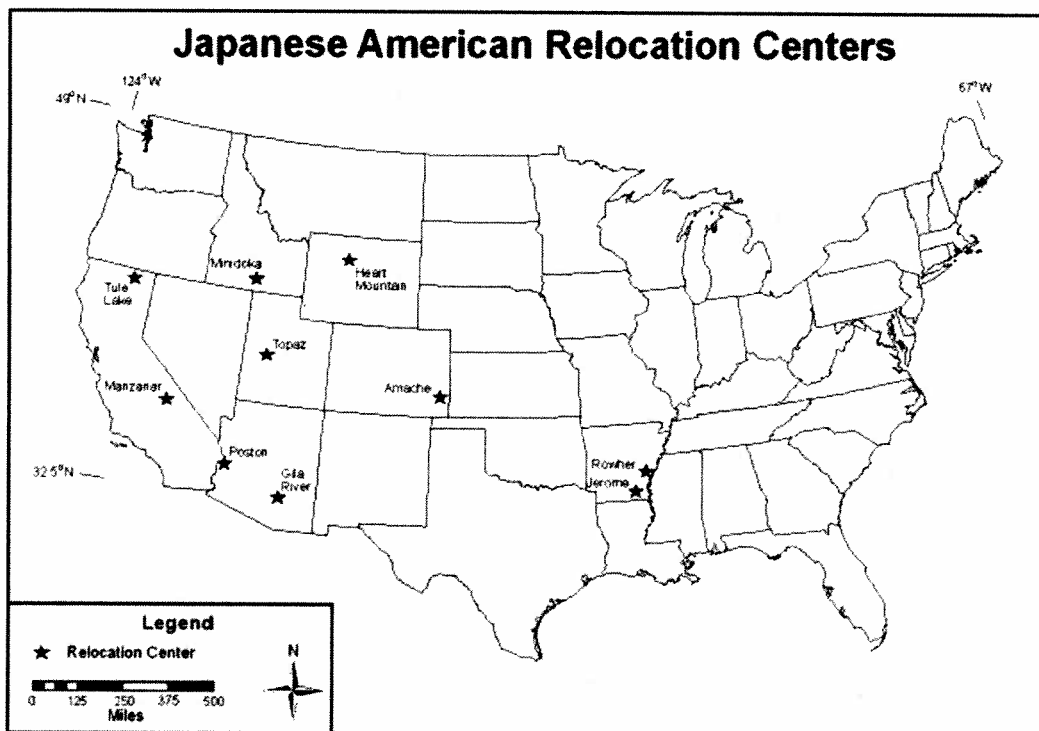
In addition to self-sufficiency and profitability, prison farms offered gainful employment, provided retraining and rehabilitation opportunities, created goods for state use, reduced costs of incarceration, generated restitution for victims, assisted inmates' families, and accumulated savings for inmates. Prison farms, in their use of relocated and incarcerated peoples, logically include the agricultural operations of World War II-era Japanese-American relocation centers.⁴

Japanese Americans have a long tradition of involvement in western US agriculture. Individuals of Japanese descent began to immigrate in significant numbers to North America's West Coast in the late nineteenth century. Most of the first generation Japanese or *Issei* settled in California, Washington, and Oregon where they toiled in the fishing, timber, and agricultural industries. Within agriculture, they began as workers in the labor-intensive vegetable and fruit crops. The *Issei* were well suited for this handwork because their traditional culture embodied both respect for the soil and hard work. Many also came from rural agricultural settings in Japan, bearing strong similarities to American truck gardening and sugar beet work. By 1910 intensive agriculture in the West, especially sugar beet cultivation, employed more than thirty-six thousand Japanese Americans. Over time, *Issei* progressed to lease, act as share-tenants, and

eventually own their own farms, all while introducing new crops and farming practices.⁵

As Japanese-American populations controlled more agricultural land, their successes fueled anti-Asian sentiment that had existed since the influx of Chinese laborers in the mid-nineteenth century. In 1913 California passed the first alien land law forbidding those ineligible for US citizenship from owning land or engaging in leases longer than three years. Other western states soon followed suit. However, second generation Japanese Americans or *Nisei*, as US citizens, were not impacted by these laws thus allowing Japanese Americans to continue to purchase land. By the advent of the United States' direct involvement in World War II, most of the nation's nearly 127,000 Japanese Americans were concentrated in coastal California, Washington, and Oregon. They were employed in a variety of economic sectors, with approximately twenty-two thousand engaged in various aspects of agriculture including produce farming and marketing.⁶

The fortunes of West Coast Japanese Americans changed dramatically with the Japanese Imperial military bombing of Pearl Harbor in December 1941. By the evening of December 7, 1941, President Roosevelt issued a proclamation stating that all Japanese "Nationals" (non-US citizens or Issei) were considered "enemy aliens." Approximately fifteen hundred enemy aliens considered to be a threat to national security were apprehended and detained beginning that evening. Executive Order 9066, issued by President Franklin D. Roosevelt in February 1942, ostensibly for national security purposes, evacuated all non-enemy alien West Coast Japanese Americans to seventeen temporary assembly centers. Subsequently, the evacuees were relocated to ten, more permanent, inland barbed wire-enclosed relocation camps (see Figure 1). Once there, evacuees were encouraged to relocate to areas away from the West Coast. Others chose to work seasonally outside the centers subsequently returning to their families in the centers when the work ended. Those adults remaining were expected but not required to work in the centers. These patterns changed dramatically for those who were deemed "disloyal" because of their responses to the February 1943 "loyalty questionnaire." Disloyal evacuees were transferred to the newly created segregation center at Tule Lake where they were imprisoned until after the end of the war or deported to Japan.⁷

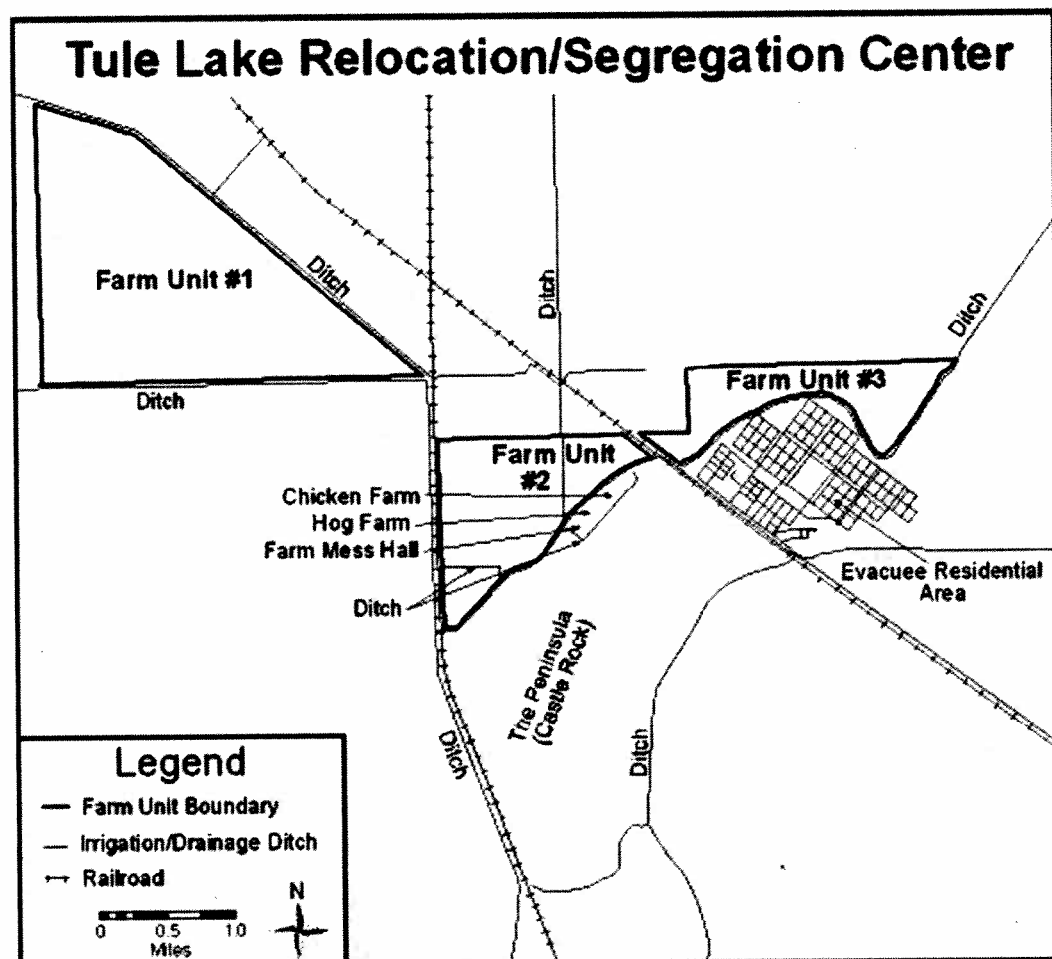
Figure 1. World War II–era Japanese-American Relocation Centers.

SOURCE: Burton et al., *Confinement and Ethnicity*, 39.

The federal government created the US War Relocation Authority (WRA) to oversee the operation of the relocation centers including food, housing, clothing, health, education, business, industry, recreation, and religion. A key aspect of each relocation center was its agricultural operations that were located on the lands surrounding its main (residential) area (see Figure 2). The agricultural aspect of the centers is not surprising given that most of the WRA's key administrators, including both directors, were former USDA employees. Evacuees were encouraged, but not required, to work in the center agricultural programs.⁸

Western lands that became relocation centers were primarily managed by various governmental entities in early 1942. The US Bureau of Reclamation oversaw the Heart Mountain, Minidoka, and Tule Lake sites as parts of large, developing irrigation projects. The City of Los Angeles owned Manzanar as a piece of its early twentieth-century land and water grab in the Owens River Valley. Gila River resided on Gila River Indian Reservation lands, whereas Poston lay on the Colorado River Indian Reservation. Both were managed by the US Bureau of

Figure 2. Map of Tule Lake Relocation Center. This shows a center agricultural operation adjacent to the evacuee residential area. Note that, at its maximum, Tule Lake housed 18,789 evacuees and segregees in the residential area.



SOURCE: Burton et al., *Confinement and Ethnicity*, 281, 295; WRA, *Evacuated People*, 17; "Project Agricultural Program Set," *Daily Tulean Dispatch*, Jun. 18, 1943, 2; "Farm Program Drafted—Jarrett," *Daily Tulean Dispatch*, Mar. 16, 1944, 2.

Indian Affairs. Only various parcels at Amache and Topaz were privately held.⁹

Parts or all of Amache, Gila River, Manzanar, Topaz, and Tule Lake had been previously farmed. Sugar beets, alfalfa, and small grains were raised on privately held Arkansas River floodplain lands that became Amache. While alfalfa grew on Gila River Indian Reservation lands, Manzanar was the site of fruit orchards as well as grain and hay fields prior to 1934. Before 1942 alfalfa and cattle were raised on some of the private irrigated

lands at Topaz whereas high-quality Durham bulls and various crops were grown on some of the land that later was Tule Lake. Bureau of Reclamation lands at Heart Mountain and Minidoka had not yet been farmed nor had Colorado River Indian Reservation lands at Poston.¹⁰

The primary goal of the WRA agricultural program was to grow food for direct consumption by the evacuee residents of each center. Next, in declining importance, was raising livestock feed crops, seed crops, and “war crops” (crops to help the war effort). Within these guidelines, each center’s goals varied slightly. Most desired to transfer crop excesses to other centers and to provide meaningful employment opportunities for evacuees. Other objectives included selling surplus produce on the open market, preparing evacuees for life after the centers, and developing lands for the post-war years. The latter point was especially important for the Bureau of Reclamation lands at Heart Mountain, Minidoka, and Tule Lake. Guidelines and production targets for center agriculture programs came from Washington, DC.¹¹

A Caucasian chief of agriculture oversaw each program and, in doing so, supervised Caucasian or evacuee superintendents and evacuee foremen and laborers. Programs were often split into operating units, each of which was overseen by an evacuee foreman. Units were based on crop or livestock type, the original farms or ranches incorporated into the center, or spatially contiguous lands. Caucasian administrators developed the center agriculture programs, often with the assistance of evacuees. Heart Mountain’s program was formed with the help of representatives from evacuee residential blocks. Program planners employed evacuees that were expert in agriculture-related fields and, when available, used soil surveys to help identify prime agricultural areas. Whereas technical input was important, WRA Chief of Agricultural Production E. L. Utz reminded Tule Lake administrators that the “WRA is not a research agency. What we are interested in is good production at reasonable cost.”¹²

Crop and livestock production in the western relocation centers, as in other agricultural programs, depended on a variety of factors. These included aspects of weather and climate, soils, pests, infrastructure, and labor. Water, however, is the most important factor in arid lands crop production. The inland, leeward locations ensured that centers received low precipitation, ranging from approximately four inches/year at Poston to fourteen inches/year at Amache (see Table 1). Low precipitation, com-

Agricultural History

Winter

Table 1. Physical Geography of the World War II-Era Western Japanese-American Relocation Centers.

	<i>Amache</i>	<i>Gila River</i>	<i>Heart Mtn.</i>	<i>Manzanar</i>	<i>Minidoka</i>	<i>Poston</i>	<i>Topaz</i>	<i>Tule Lake</i>
Dominant Landform	Interfluve/ Floodplain	Pediment/ Alluvial Fan	Pediment/ Terraces	Alluvial Fan	Volcanic Plain	Floodplain	Alluvial Fan/ Lake Basin	Lake Basin/ Tuff Cone
Mean Annual Temperature	54°F	69°F	48°F	59°F	48°F	72°F	50°F	47°F
Growing Season	162 days	247 days	133 days	210 days	123 days	297 days	117 days	80 days
Growing Degree Days	4,872	8,857	3,166	5,947	3,556	9,754	3,673	2,477
Mean Annual Precipitation	14.2 inches	8.4 inches	5.7 inches	4.6 inches	9.8 inches	4.3 inches	6.4 inches	10.3 inches
Mean Annual Evaporation	57 inches	45 inches	70 inches	84 inches	42 inches	44 inches	38 inches	38 inches
Dominant Soils	Aridisols/ Entisols	Aridisols/ Entisols	Aridisols/ Entisols	Entisols/ Inceptisols/ Mollisols	Aridisols	Entisols	Aridisols/ Entisols	Entisols/ Inceptisols/ Mollisols
SC ^a	2,230 mmho	1,460 mmho	437 mmho	?	500 mmho	977 mmho	2,790 mmho	?
SAR ^b	12	19	?	?	4	12	40	?
Dominant Native Biota	Steppe	Desert	Shrub/ Steppe	Shrub/ Steppe	Shrub/ Steppe	Desert	Shrub/ Steppe	Steppe/ Forest

SOURCE: See, Lillquist, "Imprisoned in the Desert" and sources within.

^a represents specific conductivity, a measure of the salinity hazard in irrigation water. Higher numbers mean greater hazard.

^b represents sodium absorption ratio, a measure of the sodium hazard in irrigation water. Higher numbers mean greater hazard.

bined with warm growing season temperatures and windy conditions, led to high evaporation rates and negative moisture balances. Irrigation was, therefore, a necessity for crop production.¹³

The process of irrigation was complex and labor intensive. Water came from rivers originating in distant places at all except Manzanar, which was supplied by local streams exiting the nearby Sierra Nevada. Irrigation infrastructure had to be constructed and/or repaired at each center prior to the initiation of agriculture. For example, Poston evacuees built approximately fourteen miles of main canal, seventeen miles of laterals, twenty-six miles of ditches, and sixteen miles of drainage ditches, as well as turnouts and check gates, from 1942 to 1945. Irrigation was applied by furrow or flood methods. Poston, the only site for which water consumption was calculated, used an average of 3.5 acre/feet of water per crop but ranged from 9.2 acre/feet for cucumbers to 1.3 acre/feet for spinach. A creative use of water occurred at Gila River where a small “sewer farm” was irrigated with waste water from the sewage treatment plant. Only Amache had insufficient water available at times because some of its formerly private lands had junior water rights. Irrigation water quality was also an issue. Irrigation water for all sites except Manzanar tended to be saline and had medium to high sodium absorption ratios because of arid conditions thus resulting in medium to high salinity and sodium hazards for crops. Summer thunderstorms resulted in muddy irrigation water that was detrimental to new plantings at Gila River. Too much precipitation, especially associated with intense thunderstorms, occasionally damaged crops.¹⁴

While water was paramount, other geographic factors affected crop production. The broad range of latitude (33–43°), continentality (150–750 miles inland), and elevation (300–4,700 feet above sea level) ensured a range of temperatures, and thus growing season and degree day regimes at the centers. Evacuees, in turn, responded to weather and climate in a variety of practical and structural ways. The more northern, higher elevation and/or continental sites with low mean annual temperatures, short growing seasons, and limited growing degree days (Tule Lake, Heart Mountain, Minidoka, and Topaz) had greenhouses, “cold frames” (mini-greenhouses), or “hot beds” (mini-greenhouses heated by composting manure and solar radiation) in which to start seeds and extend the growing season. Topaz greenhouses also used waste steam from the hospital

boiler room for heat. Once seedlings were moved outside, daily temperature extremes often still made it difficult to successfully grow crops. Late spring frosts wreaked havoc on seedlings, and early fall frosts further reduced the growing season. Heart Mountain evacuees attempted to protect tender transplants from late spring cold as well as wind with "hot caps" placed over individual plants. This adaptation, as well as the hot beds mentioned above, came from evacuees who dealt with similar climates in central Washington State's Yakima Valley. Cold was also a concern for livestock production. Straw from center grain harvest operations was used as cold weather bedding for Minidoka hogs and insulation for Heart Mountain chicken houses.¹⁵

Blessed with very long growing seasons and high numbers of growing degree days, the more southerly and low elevation sites of Gila River and Poston were able to "double-crop" (raise two crops each year on a given piece of land). However, too much heat was sometimes an issue. "Lathhouses" (structures built of spaced lath strips) and discarded newspapers provided shade for young plants at Manzanar and Poston. Evacuees raised brahma-crossed steers at Gila River because they could gain weight even during the hottest months. Dairy cattle were fed more in the spring so they would carry extra weight into the summer months. During extremely hot weather, Gila River chicken houses were lighted in the early morning hours to encourage feeding in the cooler time of day. Evacuees constructed shade for livestock at all centers, sometimes using native materials such as cattails and willows.¹⁶

Because of the positions of the centers in mid-latitude storm tracks, each site was windy. Local barometric pressure gradients, low-growing native vegetation, and low relief surfaces further magnified windy conditions. Evacuees battled growing season winds with windbreaks, cover crops, and hot caps. Rather than establishing tree windbreaks that required years for development, agriculturalists at Manzanar used a more practical approach—planting fast-growing barley in an attempt to provide wind protection.¹⁷

Soil types also posed a challenge. Most relocation center agricultural soils were fine textured and deep and lay on low gradient (<5°) surfaces reflecting their recent river, lake, or wind origins. Soil orders reflected the arid (aridisols), youthful (entisols and inceptisols), or grasslands (mollicsols) settings of the sites. Nearly all soils were alkaline because of aridity,

while saline soils were also found in areas of poor drainage. Most center soils had moderate to very severe limitations for irrigated agriculture because of their alkaline and/or saline nature, combined with poor drainage, stoniness, or erodability issues. One evacuee wrote "My next door neighbor is a soil chemist that leaves every morning looking for less alkali and finding more." At the extreme, some soils were too alkaline and saline for good farm productivity unless they were flushed of salts and adequately drained. However, drainage was often restricted because of the low gradient nature of the lands. The shrub steppe and desert scrub native vegetation characteristic of most of the settings offered little in the way of organic matter, hence nitrogen, in the soils. To remedy this, farm programs used livestock manure, legume-rich cover crops, crop rotation, and commercial fertilizer. Gila River lands benefitted from nitrogen-fixing alfalfa planted prior to the establishment of the center. Only at Manzanar did authorities frown upon soil amendments because the City of Los Angeles did not want to contaminate the Los Angeles aqueduct. The organic-rich drained wetlands at Tule Lake were an exception. There, an evacuee agriculturalist boasted, "Tule Lake has one of the largest agricultural projects of all relocation areas and is proud to have the best soil for growing fresh vegetables."¹⁸

Pests, both plant and animal, presented problems for crop production at each of the centers. Weeds reduced crop yields at Amache in its first year of operation. Crop pests included stray horses and cattle, gophers, rabbits, migratory waterfowl, grasshoppers, and aphids. Evacuees trapped gophers, employed dogs to hunt rabbits, and sprayed aphids with insecticides. Pests and diseases were also of concern for livestock operations. Coyotes and weasels preyed on Poston's poultry operation. Approximately 20 percent of the Manzanar chicken flock was lost over time to coccidiosis and other ailments. Enteritis and cholera hampered Poston's hog operation. Initially, infectious diseases spread at Amache because inadequate pens and housing prevented segregation of newly acquired animals from existing stock, and the dairy program ended with the discovery of brucellosis.¹⁹

Other challenges to the agricultural programs at the center were not environmental. The programs encountered infrastructure shortages because of their large scale and the coincident demand for war goods. This was especially true during the early stages of program development

when inadequate, inappropriate, or worn-out farm equipment slowed land preparation, thus limiting the size of operations. Farm development was also slowed by a lack of maintenance facilities and/or personnel. Minidoka enhanced its farm equipment repair capabilities by convincing the Idaho Department of Vocational Education to provide shop equipment and supervisory personnel for an adult education mechanics course. Evacuee blacksmiths at Amache resolved farm equipment shortages by building or modifying existing implements. Despite equipment limitations, Manzanar evacuees raised 1.6 tons of vegetables in 1942 with one rented tractor and ten mules.²⁰

Livestock infrastructure needs included fencing, pens, and housing. Even though cattle were raised at three of the sites prior to the establishment of the centers, all extant infrastructure was inadequate and dilapidated. Topaz evacuees repaired forty miles of fence and constructed eighteen new miles from late 1942 to early 1945. This, as well as other necessary agricultural structures, consumed approximately 50 percent of all agricultural workers' time during the life of Topaz. Because of a lack of materials, Gila River evacuees built hog corrals and well-ventilated shelters from nearby floodplain trees, while Heart Mountain evacuees obtained construction materials from a center-operated sawmill in the nearby Shoshone National Forest. Despite the sawmill, Heart Mountain did not have adequate hog pens, sheds, or concrete feeding platforms until summer 1944. Poultry operations faced similar problems. Brooding and laying buildings were necessary at all of the centers. Evacuees built chicken houses from abandoned wooden latrines at Minidoka and from surplus Civilian Conservation Corps buildings at Heart Mountain.²¹

Environmental and structural problems were compounded by labor shortages that plagued center agricultural programs from their beginnings. These were due to a variety of factors including evacuee backgrounds, low pay, seasonal and long-term leaves, segregation of loyal from disloyal evacuees, internal strife, theft, and cultural beliefs. Livestock operations were less impacted being less labor intensive than crop programs. For example, the Manzanar agricultural program employed only thirty to forty evacuees in livestock operations, as opposed to seventy-five to two hundred fifty in crop production. Throughout the lives of each of the centers, Caucasian administrators goaded evacuees to increase farm production. For example, the head of the agricultural division at

Topaz declared “I do not think there is any question but that evacuees will really have to get out in the fields and work if mess hall meals are to be kept up to their present levels.”²²

Farm labor shortages also occurred because evacuees chose to seasonally leave or permanently relocate from the centers to jobs where they could make higher wages and have more freedom. Pay at farms outside the centers was significantly more (\$132–\$164/month) than that earned by laborers (\$12–\$16/month) and foremen (\$16–\$19/month) inside. A Minidoka evacuee farm foreman stated to a Caucasian administrator “If you could pay them [evacuees] like on the outside, they would do the work. If you would pay fifty cents an hour instead of five cents, one-third of these people could run this farm. You don’t think of it that way.” The labor problem was especially acute when evacuee supervisors relocated from the centers. Such was the case at Amache when twenty-nine of forty-two farm supervisors relocated in spring 1944. Following the administration of the loyalty questionnaire in early 1943, 12,173 “disloyal” evacuees transferred to Tule Lake and 6,538 “loyal” evacuees moved to Amache, Gila River, Heart Mountain, Minidoka, and Topaz. These segregation-based transfers changed the nature of each center’s agricultural programs. Topaz lost most of its produce crop workers and Tule Lake lost 60 percent of its farm laborers as a result of segregation. Segregation and the aftermath of a strike ultimately shut down all Tule Lake poultry operations by January 1944. However, loyal evacuees from Tule Lake enhanced Minidoka’s agricultural programs upon their arrival in fall 1943.²³

Internal problems also affected labor. Strikes associated with a variety of work and living conditions impacted Heart Mountain, Manzanar, Minidoka, Topaz, and Tule Lake agricultural programs. Heart Mountain farm workers went on strike after their requests for better farm equipment were rejected by Caucasian farm administrators. Administrators responded by bringing in “strike breakers” from the center’s high school. “The kids found driving the equipment a lot of fun. After watching them play on the tractors for a day, the administration gave in and ordered such equipment as Dyr disc and land planes.” Tule Lake had to bring in evacuees from other centers to complete the 1943 harvest during a major strike. Interestingly, the evacuees brought in were paid prevailing “outside” wages of \$1.00–\$1.45/hour rather than standard relocation center wages. Students and volunteers helped save agricultural programs in

each of the centers during strikes as well as at other times of labor shortages. Heart Mountain and Tule Lake even had “harvest vacations” from school.²⁴

Agricultural operations were affected by another labor issue—theft. When a census revealed that two thousand chickens were missing at Heart Mountain, the center veterinarian determined that the chickens had disappeared and died as a result of “barracks sickness.” According to him, once a chicken had barracks sickness, it was taken to a barracks by an evacuee where it later died!²⁵

Cultural beliefs played into labor problems. For example, it was difficult at times to staff center slaughtering houses because of the cultural belief that butchers had a very low societal standing. As a result of this, and a shortage of facilities, large animals were often shipped out of the centers for slaughter. Hay-growing operations were also difficult to staff because of cultural beliefs. Unlike when growing produce for human consumption, evacuees saw producing animal feed demeaning.²⁶

Despite all these challenges, many of the agricultural programs were successful. Evacuee knowledge and interest in agriculture proved a key factor. Gila River benefitted from having evacuees who had years of vegetable-growing experience in rural settings. Heart Mountain’s evacuee assistant farm superintendent stated “I had the privilege of raising crops with about 500 of the finest farmers in America, including experts in soil analysis and seed growing.” Conversely, Manzanar, Minidoka, and Topaz had mostly urban populations, with fewer evacuees having agricultural backgrounds. For example, of 8,130 evacuees at Topaz at its maximum population in March 1943, only two to three hundred males had actual experience in agricultural production. Speaking of the start of farming at Minidoka, one evacuee said “And then the desert out there, we fortunately got . . . irrigation and everybody wanted to [stop] doing nothing so they all started farming. And I started farming in front of my place and I had to get books to farm. I didn’t know nothing.” Worse yet, few of the evacuees had agricultural experience in arid environments characteristic of the centers because most came from humid, temperate regions of the West Coast. Because those evacuees that had agrarian backgrounds were typically not familiar with agriculture in arid settings, the pool of experienced farmers was quite small. Organizations such as 4-H and Future Farmers of America, and adult education courses helped

interest and prepare evacuees for center agriculture as well as outside employment following relocation. Center newspapers promoted agriculture by regularly carrying articles on the various programs as did agricultural fairs that were held within the centers. Operations also benefitted from interactions with local farmers. In turn, evacuee farmers assisted local operators.²⁷

The combination of existing knowledge and education allowed the evacuees to generate a considerable quantity of produce, feed crops, and livestock. Several centers also raised seed crops and war crops, as well as ornamental crops that included flowers and shrubs. Food preservation and processing were also part of each program. However, all varied in the details of crops and livestock, acres used, and years of production. Sixty-one varieties of produce were raised for human consumption at the eight centers (see Table 2), with each one growing at least twenty different vegetable crops. Green beans, cabbage, carrots, cucumbers, daikon, lettuce, Napa cabbage, onions, peas, potatoes, squash, tomatoes, and turnips were common to all centers (see Figure 3). Celery, melons, and green peppers were also commonly grown, even in the more northern sites. Center-grown produce was preferred to produce purchased from outside producers because of its lower costs, greater freshness, and ready availability of traditional Japanese vegetables.²⁸

Largely because of the size of its agricultural evacuee population, prior land management, and long growing season, Gila River raised the most produce crops (forty-eight), on the largest area (4,434 acres), in the greatest amounts (16,368 tons) over the most years (four) (see Table 3). Gila River also led the centers in total produce shipped to other centers—three hundred train carloads totaling nearly fifty-four hundred tons (see Figure 4). Produce shipping was such a major enterprise that evacuees constructed a packing shed and special railroad siding at Gila River. Tule Lake, the second largest producer, and probably second largest exporter, also had a packing shed. In addition, Manzanar shipped excess produce to other centers.²⁹

Food preservation occurred on a grand scale in most centers via root cellars, canning, pickling, and dehydration operations. Evacuees constructed root cellars and trench silos to store a variety of produce over the winter months at Amache, Heart Mountain, Manzanar, Minidoka, Topaz, and Tule Lake. The warmest sites—Gila River and Poston—apparently

Table 2. Produce, Seed Crops^a, War Crops, and Livestock Raised at Western Japanese-American Relocation Centers, 1942–1945.

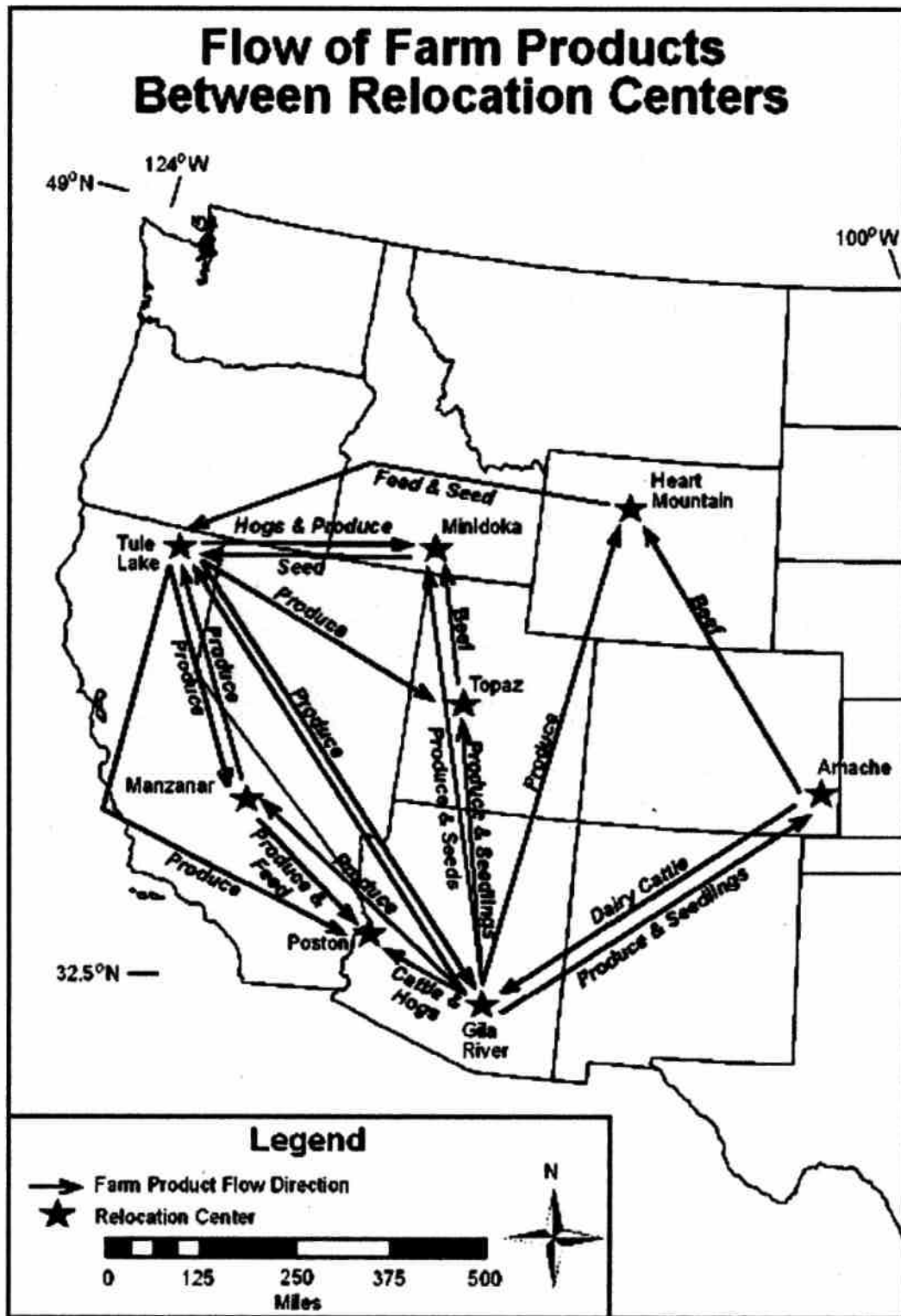
<i>Produce</i>	<i>Produce (cont.)</i>	<i>Produce (cont.)</i>	<i>Feed Crops</i>
ao uri	<i>daikon</i>	parsnips	alfalfa
asparagus	dill	peanuts	barley
<i>beans (azuki)</i>	eggplant	<i>peas</i>	beets
beans (dry)	endive	peppers (chili)	clover
beans (green/string)	<i>garlic</i>	peppers (green)	corn
<i>beans (lima)</i>	ginger	popcorn	oats
beans (mung)	gobo	potatoes	rye
<i>beans (soy)</i>	<i>goma (sesame)</i>	potatoes (sweet)	sesbania
<i>beans (tapery)</i>	habucha	pumpkins	sorghum
<i>beets (table)</i>	horseradish	<i>radishes</i>	sudan grass
<i>broccoli</i>	kohlrabi	rutabagas	sunflowers
<i>cabbage</i>	<i>lettuce</i>	sage	wheat
<i>cantaloupe</i>	<i>melons (honeydew)</i>	<i>shingiku</i>	War Crops
<i>carrots</i>	<i>melons (Persian)</i>	spinach	castor beans
casaba	<i>melons (water)</i>	<i>squash</i>	cotton
<i>cauliflower</i>	mustard greens	strawberries	flax
<i>celery</i>	mizuna	<i>sunflower</i>	Livestock
chard	<i>Napa cabbage</i>	togan	cattle (beef)
chongi	okra	<i>tomatoes</i>	cattle (dairy)
<i>corn</i>	<i>onions</i>	<i>turnips</i>	chickens
<i>cucumbers</i>	parsley		hogs
			turkeys

SOURCE: Hartman, "Heart Mountain Relocation Center"; Palmer, "Central Utah Project"; Sharp, "Colorado River Relocation Center"; Jarrett, "Tule Lake Center"; McConnell and Hill, "Manzanar Relocation Center"; Rice and Beebout, "Minidoka Relocation Center"; WRA, "**Granada Relocation Center**"; WRA, "**Gila River Project**"; Unrau, *Evacuation and Relocation*; Sakauye, *Heart Mountain*.

^aRepresented by italicized produce.

did not have root cellars, presumably because they could grow produce nearly year round or because it did not typically get sufficiently cold to damage crops that were left in the ground. Gila River, with its packing shed and railroad siding, could readily ship excesses to other centers rather than store them. However, the packing operation was hampered by shortages of crating supplies and transportation. "Unless we are going to get enough boxes or transportation to harvest the valuable vegetable

Figure 3. Agricultural Transfers between Western Japanese-American Relocation Centers, 1942–1945.



SOURCE: See notes for text.

Agricultural History

Winter

Table 3. Produce and Feed Crop Yields at the Western Japanese-American Relocation Centers, 1942-1945.

	<i>Amache</i>	<i>Gila River</i>	<i>Heart Mtn.</i>	<i>Manzanar</i>	<i>Minidoka</i>	<i>Poston</i>	<i>Topaz</i>	<i>Tule Lake</i>
Produce								
Years of Operation	2	4	2	3	2	4	2	4
Total Acres Harvested	1,044	4,434	1,166	870	534	1,004	425	3,579
Total Produce Crops	33	48	46	29	32	42	26	29
Total Production (tons)	3,025.3	16,368.3	2,707.3	3,873.6	2,795.6	3,618.8	718.7	14,952.3
Eaten at Center (tons)	2,534.8	10,927.4	2,270.5	3,629.6	2,021.1	3,618.8	718.7	?
Ship to Centers (tons)	630.3	5,395.6	90.3	424.0	774.6	0	0	?
Sold on Market (tons)	10	0	65.8	0	0	?	0	1
Feed Crops								
Years of Operation	2	3	1	2	1	2	2	4
Total Acres Harvested	3,922	3,099	639	155	314	858	8,050	4,096
Total Feed Crops	6	4	4	6	4	5	9	5
Total Production (tons)	9,493.8	3,120.8	926.3	214.0	217.6	1,122	1,505.6	2,386.2
Fed at Center (tons)	8,740.6	3,120.8	185.3	214.0	185.2	1,122	1,505.6	?
Ship to Centers (tons)	0	0	581.6	0	32.4	0	0	?
Sold on Market (tons)	1,291.4	0	159.4	0	0	0	0	2,000,000

SOURCE: Hartman, "Heart Mountain Relocation Center"; Palmer, "Central Utah Project"; Sharp, "Colorado River Relocation Center"; Jarrett, "Tule Lake Center"; McConnell and Hill, "Manzanar Relocation Center"; Rice and Beebout, "Minidoka Relocation Center"; WRA, "Granada Relocation Center"; WRA, "Gila River Project"; Unrau, *Evacuation and Relocation*; Sakaue, *Heart Mountain*.

Figure 4. Feeding Hogs Mess Hall Garbage, Tule Lake Relocation Center.



SOURCE: Francis Stewart photograph, Nov. 1942, Courtesy of the Bancroft Library, University of California, Berkeley. WRA #A-473, Sec. D, Vol. 28, Series 11: Tule Lake Relocation Center, Newell, California, WRA Photographs of the Japanese-American Evacuation and Resettlement.

crop that we have raised under the sweltering heat at \$16 per month, the talk of expanding our farm acreage or to increase production is foolish,” stated one of Gila River’s evacuee farm foremen. Large-scale canning of excess produce occurred at Amache, Minidoka, and Gila River. Additionally, Heart Mountain sent center-grown green beans to a nearby cannery. According to Heart Mountain’s evacuee assistant farm superintendent, “Once we had sixty acres of sweet corn to be canned. We went to the canning company to contract for having the corn processed, and that night it froze, and that was the end of the sixty acres of corn.” Amache, Heart Mountain, Manzanar, Minidoka, and Tule Lake had large-scale pickling operations that preserved immature or excess produce.

Heart Mountain shipped pickled daikon to other centers. Minidoka evacuees pickled cabbage, cantaloupe, carrots, daikon, honeydew, Napa cabbage, and turnips year round. However, these operations were temporarily shut down when it was discovered that workers were using the facilities to manufacture sake. Large-scale dehydration apparently only occurred at Manzanar and Gila River. Approximately one hundred tons of vegetables were dehydrated at Manzanar including peas, beans, carrots, and turnips.³⁰

Seed crops were raised at Gila River, Minidoka, and Poston. The largest seed producer, Gila River, grew over thirty different seed varieties on approximately eighty acres and became the primary seed supplier to the other centers. Among these were at least five types of traditional produce—azuki, daikon, *goma*, Napa cabbage, and *shingiku*—desired by the evacuees and difficult, if not impossible, to obtain otherwise. Heart Mountain and Minidoka also shipped seeds to other centers.³¹

War crops, including cotton (for textiles and cottonseed oil), flax (for textiles and linseed oil), and castor beans (for castor oil), were grown only at Gila River on a total of 146 acres in 1943. It is unclear why this practice was discontinued after one year. Rubber-producing guayule was grown at Poston and Manzanar. While not successful at Poston, Manzanar scientists were able to make several advances in guayule growth and production including propagation, hybridization, and processing. Guayule facilities and equipment were at a premium. “For glassware we have accumulated some jam jars and we are eating peanut butter like mad so that we can use the jars that come with it,” said one of the evacuee chemists.³²

Twelve different feed crops were grown for livestock at the centers. Topaz and Amache had the greatest diversity of feed crops (nine and six crops, respectively) and also harvested the largest number of acres (8,050 and 3,922 acres, respectively). This makes sense given the prior use of the lands and the tradition of cattle in these areas. Amache was the leader in total feed crop tonnage produced followed by Gila River. Most feed crops raised at each center were consumed in situ; however, Heart Mountain shipped considerable excess feed to other centers, and Amache, Heart Mountain, and Tule Lake sold feed on the open market.³³

Ornamental crops were also raised at the centers. Shrubs grown at center nurseries beautified the harsh environments. Flowers were raised

at Gila River, Poston, and Topaz for center hospitals as well as banquets, receptions, weddings, and funerals.³⁴

Evacuees raised cattle, hogs, and poultry. A Topaz evacuee said, "They made cowboys out of the Japanese." Most of the livestock programs ended up being feeder rather than breeder operations. Initially, most centers attempted breeder operations, as they provided better training for evacuees and because chicks, pullets, calves, and piglets were limited in availability during the war. However, breeder programs required longer lead times and were more labor-intensive than feeder operations. Labor shortages, combined with inadequate facilities and inexperienced evacuees, further limited or led to the demise of most of the breeder programs.³⁵

Beef cattle were raised at four of the centers—Amache, Gila River, Manzanar, and Topaz (see Table 4). The animals grazed on irrigated and non-irrigated lands and were fed center-grown hay, grain, and silage in feed lots. Production generally corresponded with feed crop output—Gila River, Amache, and Topaz led in beef and feed production. With nearly 3,700 butchered animals totaling over 1.3 million pounds dressed weight, Gila River topped all centers in beef production. Amache, the next most prolific cattle-producing center, butchered over 1,900 cattle and transferred excess animals to Heart Mountain. However, the loss of farm supervisors and field workers through relocation and seasonal leaves led to the abandonment of plans for Amache to raise an additional thousand head of cattle for other centers.³⁶

It is unclear why dairy cattle were raised only at Gila River and Amache. Gila River's dairy operated from 1943 through 1945 producing over 159,000 gallons of milk for the center's mess halls. A herd of approximately one hundred five cows produced over seventy-nine thousand gallons in 1945 alone. Amache's dairy herd of thirty-one cows produced only about thirty-one thousand gallons of milk in 1942 and 1943 before it was terminated because of the presence of brucellosis. Disease-free dairy cows were shipped to Gila River whereas the rest were slaughtered.³⁷

Each agricultural program raised hogs that subsisted on center garbage as well as pasture, alfalfa hay, and feed grain grown by evacuees (see Figure 5). Minidoka hogs consumed all of the center's garbage—a staggering six tons of refuse, plus hay, ground wheat, and barley—each day. A Topaz evacuee said, "the hogs ate everything we left, and ultimately we

Table 4. Livestock Yields at the Western Japanese-American Relocation Centers, 1942-1945.

	<i>Amache</i>	<i>Gila River</i>	<i>Heart Mtn.</i>	<i>Manzanar</i>	<i>Minidoka</i>	<i>Poston</i>	<i>Topaz</i>	<i>Tule Lake</i>
Beef Cattle								
Years of Operation	3	3	0	1	0	0	3	0
Total number of animals	1,943	3,656	0	361	0	0	1,462	0
Dressed Weight (lbs)	817,655	1,365,764	0	139,505	0	0	689,898	0
Chickens								
Years of Operation	3	3	2	3	3	3	3	2
Total number of animals	21,550	8,778	8,150	15,718	17,619	40,596	9,198	1,654
Dressed Weight (lbs) ^a	59,920	30,711	32,680	47,850	62,240	133,122	26,462	4,962
Eggs (dz)	20,377	176,159	94,867	113,855	90,315	127,011	82,734	29,595
Dairy								
Years of Operation	2	3	0	0	0	0	0	0
Total Milk (gals)	30,784	159,282	0	0	0	0	0	0
Hogs								
Years of Operation	4	3	2	2	3	4	3	3
Total number of animals	3,932	4,264	2,285	2,066	2,337	3,293	2,983	>3,300
Dressed Weight (lbs)	744,925	843,342	464,376	396,125	478,723	667,180	494,712	1,500,000

SOURCE: Hartman, "Heart Mountain Relocation Center"; Palmer, "Central Utah Project"; Sharp, "Colorado River Relocation Center"; Jarrett, "Tule Lake Center"; McConnell and Hill, "Manzanar Relocation Center"; Rice and Beebout, "Minidoka Relocation Center"; WRA, "Granada Relocation Center"; WRA, "Gila River Project"; Unrau, *Evacuation and Relocation*; Sakauye, *Heart Mountain*.

^a Chicken dressed weight calculated as 70 percent of total weight.

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ate the hogs.” All centers except Manzanar had hog production in 1943 and all but Heart Mountain operated into 1945. Hog production at Manzanar was not initially permitted because of the City of Los Angeles’s fears of aqueduct contamination. Tule Lake was the leading producer of hogs with 1.5 million pounds dressed weight sent to center mess halls in 1943 to 1945. Just over thirty-three hundred hogs were butchered at Tule Lake in 1945 alone. Apparently, hogs were transferred only from Tule Lake to Minidoka and from Gila River to Poston.³⁸

Poultry raised at the centers included chickens and turkeys. Chickens, like hogs, were universal to all centers and were raised for meat and eggs. Poultry were fed center-grown and milled grains and alfalfa mixed with animal protein, minerals, and supplemental feeds. Poston led the centers with over 40,500 chickens butchered totaling more than 133,000 pounds dressed weight during 1943 to 1945. Gila River was the leading egg producer with over 176,000 dozen eggs laid in the same period. Turkeys were raised only at Topaz and Tule Lake. Just over twelve hundred Topaz turkeys yielded nearly 16,500 pounds of meat in 1943 and 1944. Most became the highlights of holiday season meals at center mess halls. The Tule Lake turkey program began in April 1943 but ended eight months later when the evacuee segregation program and a major strike led to a labor shortage.³⁹

Slaughtering facilities varied from center to center. All centers slaughtered their own poultry. Amache, Poston, and Tule Lake eventually had facilities for larger animals. Those centers that lacked facilities or willing labor to operate them, hauled live large animals to private slaughtering plants in nearby towns.⁴⁰

With the lifting of the West Coast Exclusion Order in December 1944, agriculture programs began to wind down in anticipation of the closure of the relocation centers by the end of 1945. Only Gila River, Poston, and Tule Lake had produce programs in 1945, and only Gila River and Tule Lake raised feed crops that year. Because most livestock programs were at their productive peaks when the West Coast Exclusion Order was lifted, it took time for these programs to close; therefore, all but Heart Mountain had livestock programs in 1945.⁴¹

As various components of each center’s agricultural programs ended, equipment and farm supplies were surplus and lands were leased, sold, or returned to their previous owners. Evacuees had enhanced Bureau of

Reclamation lands sufficiently that no funds needed to be paid by the WRA for rental. Heart Mountain and Minidoka farmlands reverted to the Bureau of Reclamation in early 1945. Local farmers leased Heart Mountain's former farmlands in the same year. Tule Lake lands were made available to area farmers after the center's closure in March 1946. Drawings for Heart Mountain, Minidoka, and Tule Lake relocation center lands occurred from 1947–1949 with preference to war veterans. At Gila River, all WRA leases were terminated in 1947, and the land reverted to the Gila River Indian Reservation. Poston lands, returned to the Bureau of Indian Affairs in May 1945, were used to establish a colony for other Southwest Native Americans. Following closure and site cleanup, Manzanar's land and water reverted to the City of Los Angeles, which subsequently leased much of the land to local ranchers. Lands at Topaz and Amache were sold to private parties who farmed or grazed them.⁴²

Apparently, no evacuees remained to farm the lands of any of the former relocation centers. However, with the exception of Manzanar, all center agricultural lands are currently under irrigation. Contemporary agriculture even occurs on part or all of the former residential portions of Amache, Heart Mountain, Minidoka, Poston, and Tule Lake. Alfalfa has been a crop common to all of the former farmlands in the post–World War II years (see Table 5). Additionally, lands at Amache support onions, melons, wheat, and corn, while Heart Mountain lands raise sugar beets, dry beans, and barley. Sugar beets, beans, various small grains, canola, potatoes, and beef and dairy cattle grow on Minidoka area farms. Tule

Table 5. Produce, Seed Crops, Other Crops, and Livestock Raised on former Japanese-American Relocation Center Lands.

<i>Produce</i>	<i>Produce (cont.)</i>	<i>Feed Crops</i>	<i>Seed Crops</i>
beans (various dry)	onions	alfalfa	alfalfa
cantaloupes	oranges	barley	Other Crops
corn (sweet)	potatoes	canola	cotton (textile)
grapefruit	tangerines	clover	barley (brewing)
lemons	tangelos	corn (feed)	beets (sugar)
lettuce	watermelons	flax	Livestock
olives		wheat	cattle (beef)
			cattle (dairy)

SOURCE: Lillquist, "Imprisoned in the Desert."

Lake area farmers raise barley, clover, flax, and potatoes on former center lands. Alfalfa seed is grown on Topaz lands while cotton, wheat, feed grains, lettuce, and melons grow at Poston. As in the past, Gila River lands grow the most diverse crops including cotton, small grains, various citrus crops, melons, and olives. Most Manzanar lands are no longer farmed, presumably because the City of Los Angeles diverts area streams for distant domestic rather than nearby agricultural purposes.⁴³

Evacuation and subsequent imprisonment in the eight western relocation centers was a grave injustice inflicted on Japanese Americans by the US government during World War II. The evacuation was less a response to national security and more associated with hysteria and racism gripping the West Coast in the weeks following the bombing of Pearl Harbor. Because a significant percentage of Japanese Americans were involved in agriculture on the West Coast prior to evacuation, local and regional agricultural economies suffered greatly in their absence, and it is likely that overall Japanese-American agricultural production declined during the period of evacuation. However, given the backgrounds of many of the evacuees, the encouragement of the WRA, and wartime necessity, flourishing agricultural programs developed in the relocation centers. Like US prison inmate farmers dating back to the Civil War, Japanese-American evacuee farmers proved that diverse agricultural programs could succeed in the arid settings primarily because of labor-intensive farming methods, ingenuity, and the large markets provided by the centers.⁴⁴

All centers produced a significant portion of their food, while excess crops and livestock were shipped to more needy centers. Some programs offset their costs by selling excess crops and livestock on the open market. All aided the war effort by producing food that otherwise would have been purchased. Gila River successfully grew war crops and Manzanar crop scientists experimented on various strains of guayule for rubber production. All programs provided jobs for those interested in working in agriculture. Experience in these programs appears to have paved the way for evacuees to relocate outside the centers and obtain employment, much of which was associated with agriculture. Evacuee efforts to develop the lands also made it possible for "homesteaders" to successfully farm the areas after the war. Heart Mountain's evacuee assistant farm supervisor stated,

for three years Heart Mountain literally functioned as a government agricultural experiment station, leaving one of the few enduring legacies of the relocation experience—the knowledge of how to grow things in that part of the country. Working with such great people in this cooperative effort was one of [the] most satisfying experiences in my life.

Interestingly, crop diversity post–World War II has not approached that of the war years on the former relocation center farmlands. Gauged against the program goals, the relocation center agricultural programs were successful.⁴⁵

However, the realities of weather, soils, pests, labor, and infrastructure prevented the agricultural programs from being more successful. Weather, then as now, played a major role in affecting crop production in the centers. Soils required clearing, drainage, and fertilizers to produce crops. Pests had to be dealt with, sometimes in creative ways. Labor shortages hampered center agricultural programs. Agricultural infrastructure was developed—often from scratch in these remote settings—during commodity-short war times. Ironically, most of the infrastructure problems that plagued the programs in their early months had disappeared by late 1944 when the West Coast Exclusion Order was lifted but, by that time, labor was very limited. Like prison farms elsewhere, the issues of labor and infrastructure arguably played the greatest roles in limiting the success of the agricultural programs in the World War II–era Japanese-American relocation centers.

NOTES

1. This paper addresses the large-scale agricultural operations within the eight western Japanese-American relocation centers in Arizona (Gila River and Poston), California (Manzanar and Tule Lake), Colorado (Amache), Idaho (Minidoka), Utah (Topaz), and Wyoming (Heart Mountain). All lay east of the Cascade-Sierra mountain ranges and all but Amache and Heart Mountain lay west of the Rockies. Tule Lake, despite becoming a segregation center to house disloyal Japanese Americans in 1943, is included in this analysis because of its origin as a relocation center and because of its location in relation to the other western centers. The Jerome and Rowher, Arkansas, relocation centers were not included in this study because of their situation well east of, and in vastly different environments than, the remainder of the sites. Further, Jerome operated for only twenty months, the shortest duration of any of the centers.

The names of the relocation centers are sometimes confusing—Amache was also “Granada,” Minidoka was “Hunt,” Poston was referred to as “Colorado River,” Topaz was also “Central Utah,” and Gila River was sometimes called “Rivers.” For background on

various aspects of Japanese-American relocation centers, see, Roger Daniels, *Concentration Camps: North America Japanese in the United States and Canada during World War II* (Malabar, FL: Robert E. Krieger Publishing Company, Inc., 1981); Commission on Wartime Relocation and Internment of Civilians, *Personal Justice Denied* (Seattle: University of Washington Press, 1997); Jeffrey F. Burton et al., *Confinement and Ethnicity: An Overview of World War II Japanese American Relocation Sites* (Seattle: University of Washington Press, 2002); Karl Lillquist, "Imprisoned in the Desert: The Geography of World War II-Era, Japanese American Relocation Centers in the Western United States," http://www.cwu.edu/~geograph/faculty/lillquist_files/ja_relocation_cover.html (accessed Mar. 31, 2009).

2. Neal Miller and Robert C. Grieser, "The Evolution of Prison Industries," in *A Study of Prison Industry: History, Components, and Goals* (College Park, Md.: American Correctional Association, 1986), 2–4; Wayne L. Connelley et al., "Can Prison Farming Be Profitable? The Case of Arizona Correctional Industries," *Agribusiness* 9 (Mar. 1993): 258–59.

3. William E. Tydeman, "The Landscape of Incarceration: Idaho's Old Penitentiary," *Idaho Yesterdays* 38 (Summer 1994): 11–12; Judith Johnson, "Crisis in Corrections: Penitentiaries in the Far Southwest During the Great Depression," *New Mexico Historical Review* 66 (Jan. 1994): 40; David M. Oshinsky, "Worse Than Slavery": *Parchman Farm and the Ordeal of Jim Crow Justice* (New York: Free Press, 1996), 135–55, 224; John Vodicka, "Prison Plantation: The Story of Angola," *Southern Exposure* 6 (Fall/Winter 1978): 32–38.

4. Connelley et al., "Can Prison Farming Be Profitable?" 258–59.

5. J. L. De Witt, *Japanese Evacuation from the West Coast, 1942: Final Report* (Washington, DC: GPO, 1943), 79, 86; Masakazu Iwata, *Planted in Good Soil: The History of the Issei in United States Agriculture*, 2 vols. (New York: Peter Lang, 1992); Eric Walz, "From Kumamoto to Idaho: The Influence of Japanese Immigrants on the Agricultural Development of the Interior West," *Agricultural History* 74 (Spring 2000): 404–18.

6. Eric Walz, "Japanese Settlement in the Intermountain West, 1882–1946," in *Guilt by Association: Essays on Japanese Settlement, Internment, and Relocation in the Rocky Mountain West*, ed. Mike Mackey (Powell, Wyo.: Western History Publications, 2001), 1–24; De Witt, *Final Report*, 79, 86.

7. The US government's version of evacuation is detailed in De Witt, *Final Report*, 3–49. A more recent perspective of relocation, seasonal leaves, and segregation is presented in *Personal Justice Denied*, 180–84, 191–212.

8. De Witt, *Final Report*, 51; Dillon S. Myer, *Uprooted Americans: The Japanese Americans and the War Relocation Authority During World War II* (Tucson: University of Arizona Press, 1971), 6; Milton S. Eisenhower, *The President is Calling* (New York: Doubleday & Company, Inc., 1974), 113, 115.

9. Heart Mountain was part of the Heart Mountain Division of the Shoshone Project, Minidoka lay within the Gooding Division of the Minidoka Project, and Tule Lake occupied the Tule Lake Division of the Klamath Project. For further information on the ownership and management of lands prior to relocation, see, Carl J. Thye, "The Bureau Reclaims its Own," *Reclamation Era* 33 (Apr. 1947): 90–94; Harlan D. Unrau, *The Evacuation and Relocation of Persons of Japanese Ancestry During World War II: A Historical Study of the Manzanar War Relocation Center* (Washington, DC: National Park Service, 1996), 123–85; Burton et al., *Confinement and Ethnicity*, 59, 101, 215, 259.

10. Wendell W. Palmer, "Closing Report, Agricultural Section, Central Utah Project, Topaz, Utah," Sec. B3, Reel 16, Field Basic Documentation (hereafter FBD) 1945, Records of the War Relocation Authority (hereafter WRA), 1942–1946, RG 210, National Archives

and Records Administration, Washington, DC (hereafter NARAI); Unrau, *Evacuation and Relocation*, 123–85; Burton et al., *Confinement and Ethnicity*, 68; Stan Turner, *The Years of Harvest: A History of the Tule Lake Basin*, 3rd ed. (Eugene, Ore.: Spencer Creek Press, 2002), 109, 121; Lawrence McMillan in discussion with the author, Apr. 11, 2003, Granada, Colo., notes in possession of author.

11. For more information on the overall goals of the relocation center agricultural programs, see, Dillon S. Myer, "Policies Governing Agricultural Production and Utilization," *Poston Official Bulletin*, July 11, 1942, 1–3; WRA, *Agriculture Handbook* (Supplementing Manual Section 40.1) (Washington, DC: GPO, 1943). For specific goals of the agricultural programs of each of the centers, see, Glenn T. Hartman, "Heart Mountain Relocation Center Agricultural Section Final Report," Reel 63; Palmer, "Central Utah Project," Sec. A1; William C. Sharp, "Agriculture in Poston: 1942–1945. Colorado River Relocation Center, Poston, Arizona," p. 1, Reel 32; WRA, "Historical Report, Operations Division—Agricultural Section, Granada Relocation Center, Amache, Colorado," p. 1, Reel 54; WRA, "Final Project Report, Operations Division, Agriculture Section, Gila River Project," p.1, Sec. 2, Reel 43, FBD 1945; William T. Jarrett, "General Outline and History of the Agricultural Program at Tule Lake Center," p. 1, Reel 114; Horace R. McConnell and Henry A. Hill, "Agriculture Section, Manzanar Relocation Center, Manzanar, California," p. 1, Reel 78; Louis E. Rice and Rhuel D. Beebout, "Report of the Agriculture Section, Minidoka Relocation Center, Hunt, Idaho," p. 2, Reel 89, FBD 1946, Records of the WRA, 1942–1946, RG 210, NARAI.

12. Hartman, "Heart Mountain Relocation Center," 8; WRA, "Granada Relocation Center," 2; WRA, "Gila River Project," 10; McConnell and Hill, "Manzanar Relocation Center," 1–2; Jarrett, "Tule Lake Center," 2; Palmer, "Central Utah Project," Sec. A1, 2; "Frost Terror Worries Farmers," *Daily Tulean Dispatch*, Aug. 20, 1942, 2. Heart Mountain's agricultural department roster is shown in Eiichi E. Sakauye, *Heart Mountain: A Photo Essay* (San Mateo, Calif.: Self-Published, 2000), 149.

13. For overall information on factors affecting agricultural programs, see, D. Wynne Thorne, "Irrigated Farming in Arid and Semi-Arid Temperate Zones," in *Soil, Water, and Crop Production*, ed. D. Wynne Thorne and Marlowe D. Thorne (Westport, Conn.: AVI Publishing Company, Inc., 1979), 238–40; C. Wiley Hinman and Jack W. Hinman, *The Plight and Promise of Arid Land Agriculture* (New York: Columbia University Press, 1992), 46. "Moisture balance" refers to the balance between precipitation and evapotranspiration. A negative moisture balance means that more moisture potentially leaves the soil via evapotranspiration than falls as precipitation.

14. Sharp, "Colorado River Relocation Center," 10–11, 38; Burton et al., *Confinement and Ethnicity*, 68; WRA, "Granada Relocation Center," 8; WRA, "Gila River Project," 20–21, 26; "Extensive Crop Damage Caused by Hailstorm; Delay in Harvest Seen," *Heart Mountain Sentinel*, June 17, 1944, 1; "Farm Crops Damaged by Hail, Frost," *Heart Mountain Sentinel*, Oct. 7, 1944, 1. One acre-foot of water is the amount of water required to cover one acre of land to a depth of one foot.

15. Degree days are calculated as the difference between a 45°F base temperature and the daily mean temperature summed for the entire year. For more information on the impacts of low temperatures on relocation center agriculture, see, Hartman, "Heart Mountain Relocation Center," 19, 26; Palmer, "Central Utah Project," Sec. C1; Rice and Beebout, "Minidoka Relocation Center," 22, 41, 74, 101, 114–15; "Thousands of Hot Caps Dot Project Farm: Panorama Unfamiliar in Wyoming," *Heart Mountain Sentinel*, June 10, 1944, 8.

Growing degrees come from the historical summaries at the Western Regional Climate Center (<http://www.wrcc.dri.edu>) for each of the following sites: Lamar, Colorado; Sacaton, Arizona; Powell, Wyoming; Independence, California; Shoshone 1 WNW, Idaho; Parker 6 NE, Arizona; Deseret, Utah; and Tulelake, California (accessed on May 20, 2009). Information on Yakima Valley, Washington, farmer influences on Heart Mountain farming practices is from Sakauye, *Heart Mountain*, 48, 50.

16. Sharp, "Colorado River Relocation Center," 4; WRA, "Gila River Project," 5–6, 21, 25; "Agriculture Dept. Uses Discarded Newspapers," *Poston Chronicle*, June 26, 1943, 1; Burton et al., *Confinement and Ethnicity*, 222, 225; "Lath House Planned for Nursery Dept.," *Official Daily (Poston, Ariz.) Press Bulletin*, July 28, 1942, 1.

17. McConnell and Hill, "Manzanar Relocation Center," 2; "Unusual Weather Dangers Crops at Local Farm," *Manzanar Free Press*, June 12, 1943, 1; Unrau, *Evacuation and Relocation*, 442, 562.

18. Lillquist, "Imprisoned in the Desert"; Hartman, "Heart Mountain Relocation Center," 6–7, 30; Rice and Beebout, "Minidoka Relocation Center," 22, 49, 60; WRA, "Gila River Project," 1, 17; McConnell and Hill, "Manzanar Relocation Center," 4; Audrie Gardner and Anne Loftis, *The Great Betrayal: The Evacuation of the Japanese-Americans During World War II* (London: Collier-Macmillan Ltd., 1969), 232; "Raise 2000 Acres of Vegetables Here," *Daily Tulean Dispatch*, June 24, 1943, 4.

19. WRA, "Granada Relocation Center," Appendix; "Agriculture," *Manzanar Free Press*, Mar. 20, 1943, 4; Sharp, "Colorado River Relocation Center," 33; WRA, "Gila River Project," 20–21; Jarrett, "Tule Lake Center," 3; Rice and Beebout, "Minidoka Relocation Center," 78, 87, 103, 114–15; "Coyote Traps Laid at Poultry Farm," *Poston Chronicle*, May 18, 1944, 4; "Beware of Poultry Traps at Farm," *Poston Chronicle*, Dec. 9, 1944, 4; McConnell and Hill, "Manzanar Relocation Center," 12; Palmer, "Central Utah Project," Sec. C6.

20. Hartman, "Heart Mountain Relocation Center," 14, 19–21, 27; Sharp, "Colorado River Relocation Center," 35–36; Rice and Beebout, "Minidoka Relocation Center," 23–24, 72–73; WRA, "Granada Relocation Center," Appendix; McConnell and Hill, "Manzanar Relocation Center," 14; Palmer, "Central Utah Project," Secs. A, C5; WRA, "Gila River Project," 11.

21. Hartman, "Heart Mountain Relocation Center," 14, 19–21, 27; Rice and Beebout, "Minidoka Relocation Center," 23–24, 72–73; Palmer, "Central Utah Project," Secs. A, C5; WRA, "Gila River Project," 11.

22. For more information on the general impacts of farm labor on relocation center agriculture, see, McConnell and Hill, "Manzanar Relocation Center," 6; "Future Meals Depend on Resident Farm Help Now," *Topaz Times*, June 15, 1943, 2.

23. Rice and Beebout, "Minidoka Relocation Center," 39, 45, 50; Jarrett, "Tule Lake Center," 2, 4–5, 10; WRA, "Granada Relocation Center," 5; WRA, *The Evacuated People: A Quantitative Description* (Washington, DC: GPO, 1946), 17, 168; Palmer, "Central Utah Project," Sec. A; US Department of Commerce, *Historical Statistics of the United States: Colonial Times to 1957* (Washington, DC: US Department of Commerce, Bureau of the Census, 1960), Series D, 654–68. The "loyalty questionnaire" (or the "Application for Leave Clearance") was administered to evacuees in each of the relocation centers in early 1943. This questionnaire sought to determine, among other things, the loyalty of Japanese Americans to the United States. The questionnaire was very divisive to families and communities within the centers—e.g., an Issei answering "yes" to Question 28—Will you swear unqualified allegiance to the United States of America and forswear any form of allegiance or obedience to

the Japanese emperor, or any other foreign government, power or organization?—was forced to renounce Japanese citizenship without being able to become a US citizen.

24. Hartman, "Heart Mountain Relocation Center," 15–17; McConnell and Hill, "Manzanar Relocation Center," 15; Rice and Beebout, "Minidoka Relocation Center," 37; Palmer, "Central Utah Project," Sec. A; Jarrett, "Tule Lake Center," 3, 5; "Residents Save Huge Crop at Tule Lake," *Poston Chronicle*, Nov. 12, 1943, 1–2; Sakauye, *Heart Mountain*, 51.

25. Mike Mackey, *Heart Mountain: Life in Wyoming's Concentration Camp* (Powell, Wyo.: Western History Publications, 2000), 134–35; Rice and Beebout, "Minidoka Relocation Center," 135; "Crop Pilfering Causes Shortage: Severe Penalties to be Imposed," *Gila News-Courier*, May 11, 1943, 3.

26. Jarrett, "Tule Lake Center," 8; WRA, "Gila River Project," 25–26.

27. WRA, "Gila River Project," 5, 25–26; Japanese American National Museum, "The Camps," <http://www.janm.org/projects/clasc/map.htm> (accessed Feb. 21, 2007); WRA, *Evacuated People*, 17; Palmer, "Central Utah Project," Sec. A2; WRA, "Granada Relocation Center," 5, Appendix; "4-H Club," *Daily Tulean Dispatch*, July 7, 1942, 3; "To Educate Farmers," *Daily Tulean Dispatch*, July 4, 1942, 5; "Ag. Course May be Started," *Poston Chronicle*, Feb. 20, 1943, 3; Rice and Beebout, "Minidoka Relocation Center," 10, 29–30; Jarrett, "Tule Lake Center," 7–8; "Action Devised for Agriculture by Mathiesen," *Official Daily Press Bulletin*, Oct. 20, 1942, 1; Patricia N. Limerick, *Something in the Soil: Legacies and Reckonings in the New West* (New York: W. W. Norton & Company, 2000), 200–13; Sakauye, *Heart Mountain*, 47; Girdner and Loftis, *Great Betrayal*, 231; Robert T. Hayashi, *Haunted by Waters: A Journey Through Race and Place in the American West* (Iowa City: University of Iowa Press, 2007), 86.

28. Lillquist, "Imprisoned in the Desert"; McConnell and Hill, "Manzanar Relocation Center," 1, 2, 16.

29. WRA, "Gila River Project," 18, plus tables, Sec. 2, 4; Jarrett, "Tule Lake Center," 4; "Tule Vegetables Sent to Project," *Topaz Times*, Dec. 11, 1943, 1; "Vegetables Arrive From Tule Lake," *Minidoka Irrigator*, Oct. 31, 1942, 3; H. R. McConnell, "Agricultural Division Annual Report Calendar Year 1943," Manzanar, California, pp. 2–3, Reel 76, FBD 1945, Records of the WRA, 1942–1946, RG 210, NARA I; "Rivers Exports More Produce," *Gila News-Courier*, Jan. 14, 1943, 3; "Newell Supplies Poston with Vegetables," *Poston Chronicle*, Aug. 21, 1943, 3; "75 Carloads Leave Gila," *Gila News-Courier*, May 6, 1943, 5; "Tsukemono Pickling Plant in Full Operation Here," *Daily Tulean Dispatch*, Jan. 9, 1943, 1; "64 Cars of Produce Shipped to Centers," *Daily Tulean Dispatch*, Oct. 2, 1943, 1; "Vegetables Shipped," *Daily Tulean Dispatch*, Aug. 31, 1942, 1; "Ship Local Vegetables," *Daily Tulean Dispatch*, Aug. 21, 1943, 1.

30. WRA, "Granada Relocation Center," Appendix; Hartman, "Heart Mountain Relocation Center," 17, 27; Rice and Beebout, "Minidoka Relocation Center," 29, 43, 122–25; Palmer, "Central Utah Project," Sec. C1; Jarrett, "Tule Lake Center," 3, 6; WRA, "Gila River Project," 9; "Heart Mountain Farm Crop to be Canned," *Heart Mountain Sentinel*, Aug. 28, 1943, 8; Unrau, *Evacuation and Relocation*, 560; Burton et al., *Confinement and Ethnicity*, 165; Sakauye, *Heart Mountain*, 56; "Tsukemono Pickling Plant"; "Shortages Sabotage Vegetable Crop," *Gila News-Courier*, Dec. 2, 1942, 3; Girdner and Loftis, *Great Betrayal*, 230–31.

31. Takeichi Kadani, "Farm Expansion Plans Proceed Despite Delays," *Poston Chronicle*, Apr. 18, 1943, 1; WRA, "Gila River Project," 12; Rice and Beebout, "Minidoka Relocation Center," 46–47.

32. WRA, "Gila River Project," 15; Alexander H. Leighton, *The Governing of Men: General Principles and Recommendations Based on Experience at Japanese Relocation Camp* (Princeton: Princeton University Press, 1945), 146; Unrau, *Evacuation and Relocation*, 564–65; Girdner and Loftis, *Great Betrayal*, 234.

33. Hartman, "Heart Mountain Relocation Center," G1; WRA, "Granada Relocation Center," 10; Jarrett, "Tule Lake Center," 6–7; "Local Farm Products Sold," *Heart Mountain Sentinel*, Mar. 21, 1945, 8.

34. Sharp, "Colorado River Relocation Center," 50–51; WRA, "Gila River Project," 9; Palmer, "Central Utah Project," Sec. C3.

35. Palmer, "Central Utah Project," Secs. C5, C6; McConnell and Hill, "Manzanar Relocation Center," 7–8; Jarrett, "Tule Lake Center," 8–9; Girdner and Loftis, *Great Betrayal*, 233.

36. WRA, "Granada Relocation Center," 12–13; Palmer, "Central Utah Project," Sec. C5; "30 Head of Beef Cattle Sent to Heart Mountain," *Granada Pioneer*, Feb. 12, 1944, 1; "Cattle Raising, Sale of Alfalfa Discussed," *Granada Pioneer*, June 21, 1944, 1.

37. WRA, "Gila River Project," tables; WRA, "Granada Relocation Center," 13–14.

38. WRA, "Gila River Project," 18–22; Rice and Beebout, "Minidoka Relocation Center," 94, 95, 98, 110, 101; Hartman, "Heart Mountain Relocation Center," 22, 29; McConnell and Hill, "Manzanar Relocation Center," 8–10; Jarrett, "Tule Lake Center," 13; Mine Okubo, *Citizen 13660* (Seattle: University of Washington Press, 1983), 196.

39. McConnell and Hill, "Manzanar Relocation Center," 11–12; Palmer, "Central Utah Project," Sec. C4; Jarrett, "Tule Lake Center," 10.

40. WRA, "Granada Relocation Center," Appendix; Sharp, "Colorado River Relocation Center," 36; Jarrett, *Tule Lake Center*, 8; WRA, "Gila River Project," 20; Hartman, "Heart Mountain Relocation Center," 22; Rice and Beebout, "Minidoka Relocation Center," 103–105, 117–18; Palmer, "Central Utah Project," Sec. C6.

41. Burton et al., *Confinement and Ethnicity*, 56–57; Hartman, "Heart Mountain Relocation Center"; Palmer, "Central Utah Project"; Sharp, "Colorado River Relocation Center"; WRA, "Granada Relocation Center"; WRA, "Gila River Project"; Jarrett, "Tule Lake Center"; McConnell and Hill, "Manzanar Relocation Center"; Rice and Beebout, "Minidoka Relocation Center."

42. Thye, "The Bureau Reclaims its Own," 90–94; "Farm Land Returned to Bureau," *Minidoka Irrigator*, Feb. 3, 1945, 1; "Farmland at Heart Mountain Will Revert to Reclamation," *Heart Mountain Sentinel*, Feb. 24, 1945, 6; "Farm Lands Leased to 'Outsiders': Agriculture Terminates as Local Farmers Seek All Fertile Acres Developed," *Heart Mountain Sentinel*, Mar. 24, 1945, 1; Beryl G. Churchill, *Dams, Ditches, and Water: A History of the Shoshone Reclamation Project* (Cody, Wyo.: Rustler Printer and Publishing, 1979), 88–90; Burton et al., *Confinement and Ethnicity*, 207; Turner, *Years of Harvest*, 303–24; Indian Claims Commission, Docket Number 236-A, 236-B, Findings of Fact 25 (1971): 260–77, <http://digital.library.okstate.edu/icc/v25/v25toc.html> (accessed Oct. 10, 2006); Ruth Y. Okimoto, "Sharing a Desert Home: Life on the Colorado River Indian Reservation, Poston, Arizona, 1942–1945," *News from Native California* (a special report) (2001): 15–17; Unrau, *Evacuation and Relocation*, 799–820; Jane Wehrey, *Voices From This Long Brown Land: Oral Recollections of Owens Valley Lives and Manzanar Pasts* (New York: Palgrave, 2006), 13; Leonard J. Arrington, *The Price of Prejudice: The Japanese-American Relocation Center in Utah During World War II* (Delta, Utah: Topaz Museum, 1997), 55; Lawrence McMillan in discussion with the author, Apr. 11, 2003, notes in possession of author.

43. Charles Creech in discussion with the author, Apr. 12, 2003, Granada, Colo., notes in possession of author; Palmer, "Central Utah Project," Sec. A4; Les and Nora Bovee in discussion with the author, June 18, 2003, Powell, Wyo., notes in possession of author; Bessie M. Shrontz Roberts-Wright, *Hunt for Idaho: Evacuees 1942-1945 and Homesteaders 1947-1949 TP Minidoka Prisoner of War Camp 1942-1945* (np: Self-Published, 1994); Turner, *Years of Harvest*, 306-17; Robert Stone in discussion with the author, Dec. 20, 2002, Sacaton, Ariz., notes in possession of author; Okimoto, "Sharing a Desert Home," 18.

44. Commission on Wartime Relocation and Internment of Civilians, *Personal Justice Denied*; WRA, *Evacuated People*, 17.

45. Sakauye, *Heart Mountain*, 50; Arrington, *Price of Prejudice*, 49.