

**The Desert Blossoms as a Wasteland:  
An Environmental History of Utah's West Desert**

By

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## **ABSTRACT**

This study illustrates how the isolation and perceived worthlessness of the Great Basin's West Desert led the military and livestock industry to create a sacrificial landscape. In focusing on the material activities of these two groups, this study also explores vital yet largely neglected issues regarding the tensions between the defense industry, economic prosperity, and ecological health, revealing the largely unacknowledged social and ecological costs of maintaining national security. The narrative traces the nineteenth-century rise of the sheep industry, growing friction between pastoral and national security landscapes in the mid twentieth century, and the social and environmental consequences of Army weapons testing programs during World War II and the Cold War. In focusing on Western settlement and early economic development, as well as the critical period during and after WWII, this study offers an extended view into North Americans' largely dysfunctional relationship to arid lands.

*Dedicated to my mother*

*The wilderness and the dry land shall be glad; and the desert shall rejoice, and blossom as the rose.*

-Isaiah 35:1

*In the deserts of the American West, you can find clear signs that key aspects of our culture are not viable and may even be suicidal.*

-Chip Ward in *Canaries on the Rim: Living Downwind in the West*

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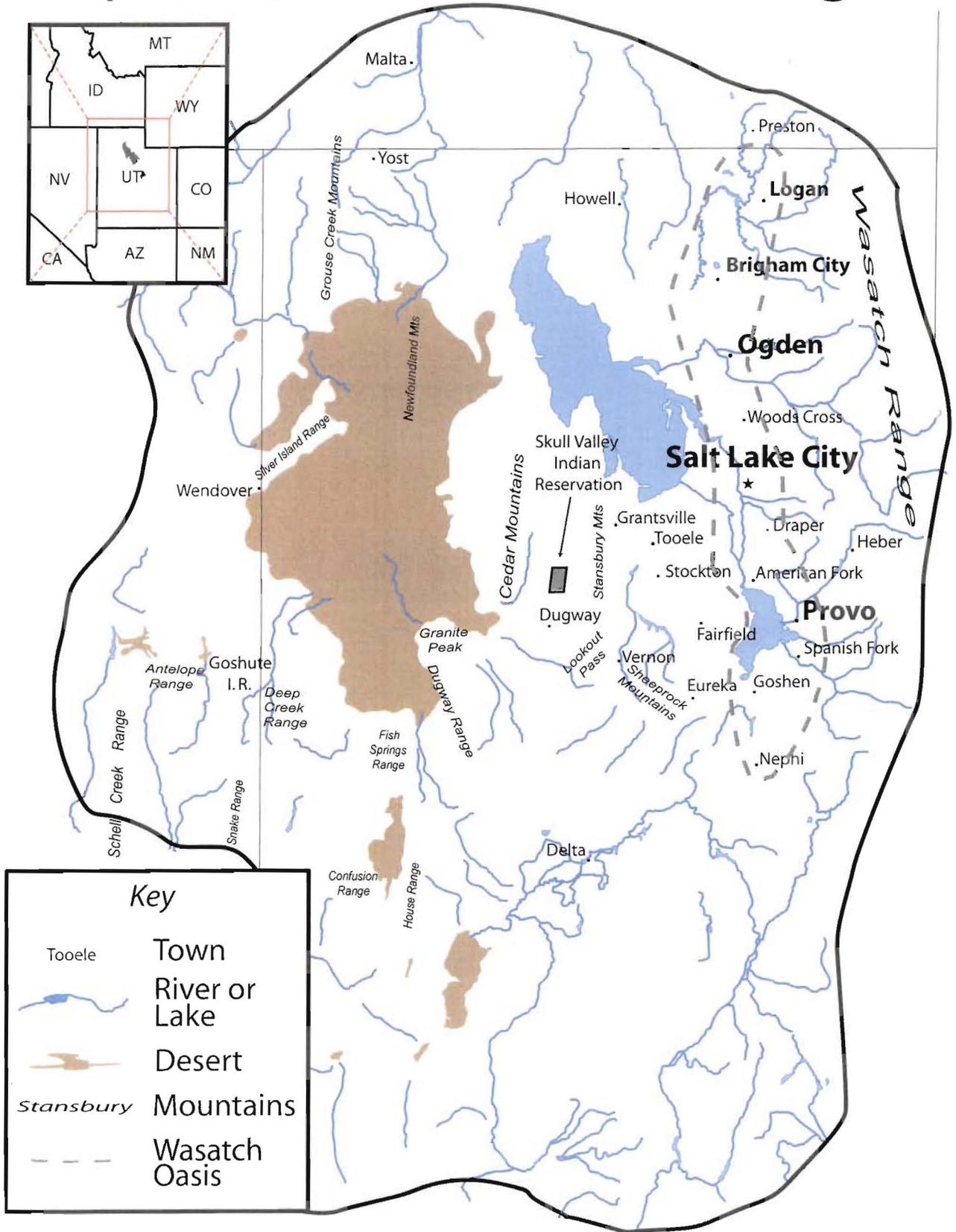
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**LIST OF ACRONYMS**

AEC—	Atomic Energy Commission
AUM—	Amount of Forage Required by an Animal Unit for one Month
BLM—	Bureau of Land Management
BW—	Biological Weapons
CBR—	Chemical, Biological, and Radiological
CBW—	Chemical and Biological Weapons
CW—	Chemical Weapons
CWS—	Chemical Warfare Service
DCD—	Deseret Chemical Depot
DLC—	Deseret Live Stock Company
DPG—	Dugway Proving Ground
R&D—	Research and Development
TA-182—	Tantalum-182
TAD—	Tooele Army Depot
UofU—	University of Utah
USAAF—	United States Army Air Forces
UXO—	Unexploded Ordnance
VEE—	Venezuelan Equine Encephalitis
WWII—	World War II

# Map 1: The Bonneville Basin Region



## INTRODUCTION

The skies were clear and sunny in the West Desert on the morning of March 13, 1968. Test directors at Dugway Proving Ground, the U.S. Army's secret chemical, biological, and radiological weapons testing reserve in western Utah, prepared the third and final field test of a newly-developed chemical spray tank. By the late afternoon, however, winds had begun to gust out of the southwest at speeds up to 35 miles per hour. A thunderstorm also brewed in the distance. These blustery conditions apparently did not warrant cancellation of the field test. At 5:30pm, an F-4E Phantom Fighter jet equipped with two spray tanks whisked over a Dugway test grid at an altitude of 150 feet.<sup>1</sup> On its course it dispersed 300 pounds of VX nerve agent, an extraordinarily lethal organophosphate chemical compound. Then a valve on one of the spray tanks malfunctioned, and, as the jet swerved upward from the grid, twenty pounds of VX were released at elevations of up to 1,500 feet. Dugway test directors saw little danger in this inadvertent release. They called it day and went home for dinner.<sup>2</sup>

Less than two hours after the test, a cold front generating strong updrafts passed over the Dugway area, and winds shifted to the east. Across the region rain fell on the

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<sup>1</sup> Altitudes are given relative to the valley floor, which was approximately 4,300 feet above sea level.

<sup>2</sup> For further details, see House Committee on Government Operations, *Environmental Dangers of Open-Air Testing of Lethal Chemicals: Hearings Before a Subcommittee on Government Operations*, 91<sup>st</sup> Cong., 1<sup>st</sup> Sess., 20 and 21 May 1969 (Washington, D.C.: Government Printing Office, 1969), 1-7; House Committee on Government Operations, *Environmental Dangers of Open-Air Testing of Lethal Chemicals: Tenth Report*, 91<sup>st</sup> Cong., 1<sup>st</sup> Sess., No. 91-633 (Washington, D.C., Government Printing Office, 1969), 1-2; Jonathan B. Tucker, *War of Nerves: Chemical Warfare from World War I to Al-Qaeda* (New York: Pantheon, 2006), 204-206; Albert J. Mauroni, *America's Struggle with Chemical-Biological Warfare* (Westport, CN: Praeger, 2000), 34; Phillip Boffrey, "Nerve Gas: Dugway Accident Linked to Utah Sheep Kill," *Science* 162 (27 December 1968): 1460-1463; Virginia Brodine, Peter P. Gaspar, and Albert J. Pallamann, "The Wind From Dugway," *Environment Science* 2 (Winter 1969) reproduced in House Hearings, *Environmental Dangers, 209-210*; Robert G. Fowler, "How the Sheep Died in Skull Valley," *Farm Journal* (July 1969), PAM 10918, Utah Historical Research Center, Salt Lake Utah, 25; Erik Sparke, "Death of Sheep," *Australian National University Historical Journal* 15 (1981-1987), L. Tom Perry Special Collections Library, Harold B. Lee Library, Brigham Young University, Provo, Utah, 89.

valley floors and snow blanketed nearby mountain ranges.<sup>3</sup> The next morning, two shepherders on the southeast side of Cedar Mountain in Skull Valley, about twenty-five miles east of the test grid, discovered many of their 2,800 sheep were acting “crazy in the head.”<sup>4</sup> The sheeps’ heads drooped abnormally, profuse fluid dripped from their noses, and many could not stand.<sup>5</sup> Over the next three to four days, thousands of sheep in Skull Valley dropped dead. In total 6,278 sheep were affected and all 2,800 of the sheep on Cedar Mountain eventually died.<sup>6</sup> The sick sheep were in a zone that fanned east from the test grid over a fifty-mile long and twenty-five-mile wide area. Levels of illness and death were highest in flocks closest to the proving ground, gradually growing less severe farther to the east.<sup>7</sup> While some rabbits, birds, and rodents displayed similar symptoms, no cattle, horses, dogs, or humans appeared affected.<sup>8</sup>

News of the disaster attracted the attention of the media as well as federal, state, and military authorities.<sup>9</sup> The closer investigators looked, the more it seemed like the VX tests were only one of many ways that the military was harming sheep and many other forms of nature. The incident, which occurred during the same week as the My Lai massacre in Vietnam, became another black eye for the military establishment. Not only did the sheep kill foster widespread mistrust of the military and government, it also

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<sup>3</sup> House Report, *Environmental Dangers*, 5-6; Tucker, “War of Nerves,” 206; Boffrey, “Nerve Gas,” 1461; Brodine, “Wind from Dugway,” 210; Spark, “Death of Sheep,” 89.

<sup>4</sup> Boffrey, “Nerve Gas,” 1461.

<sup>5</sup> House Report, *Environmental Dangers*, 6; Brodine, “Wind from Dugway,” 210.

<sup>6</sup> According to estimates, a total 4,453 sheep died or were destroyed as a result of nerve agent exposure. For further details, see House Report, *Environmental Dangers*, 6.

<sup>7</sup> House Report, *Environmental Dangers*, 6; Tucker, “War of Nerves,” 208.

<sup>8</sup> House Report, *Environmental Dangers*, 10-11; House Hearings, *Environmental Dangers*, 85; Tucker, “War of Nerves,” 211. There are some allegations that humans were affected, see Lee Davidson, “Nerve Gas Likely Caused Lifelong Ills,” *Deseret News*, 22 December 1994.

<sup>9</sup> Boffrey, “Nerve Gas,” 1460.

contributed to a ban of open-air chemical tests in 1969 and gave greater credence to Rachael Carson's warnings about the insidious dangers of chemicals.<sup>10</sup>

The broader social and political impacts of the Skull Valley sheep deaths have received significant attention from journalists and historians, but beyond the headlines lies a complicated story about how people utilized and inhabited lands that seemed worthless. Environmental historian Mark Fiege has noted the importance of studying “unappealing” and “hard-used” landscapes, arguing that such places are where we “directly confront the reality of our deeply tangled and problematic relationship to the natural world that we inhabit.”<sup>11</sup> The West Desert is one such place. This relatively arid and desolate region sits on the eastern edge of the Great Basin, between the Wasatch Mountains and the Nevada state line.<sup>12</sup> Of all the areas in the Great Basin, the largest and least inhabited desert in North America, the West Desert is one of the harshest.<sup>13</sup> This is mainly because it lies in the bottom of the Bonneville Basin, the biggest interior basin in the Great Basin. Thus the West Desert, as activist Stephen Erickson has noted,

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<sup>10</sup> Sparke, “Nerve Gas,” 89, 93; Tucker, “War of Nerves,” 216-217; Mauroni, *Chemical-Biological Warfare*, 50-51; House Report, *Environmental Dangers*, 29-32; Rachael Carson, *Silent Spring* (Greenwich, CN: Fawcett Publication, inc., 1970).

<sup>11</sup> Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape* (Seattle: University of Washington Press, 1999), 10.

<sup>12</sup> The “West” Desert is a conceptual designation of the arid region lying west of the more lush and humid areas lying along the base of the Wasatch Mountains where most inhabitants of the region live.

<sup>13</sup> For more details on the natural history of the Great Basin, see Mary Austin, *The Land of Little Rain* (New York: Penguin Books, 1997); Michael P. Cohen, *A Garden of Bristlecones: Tales of Change in the Great Basin* (Reno: University of Nevada Press, 1998); Craig Denton, *People of the West Desert: Finding Common Ground* (Logan: Utah State University Press, 1999), 5-11; Mark Fiero, *Geology of the Great Basin* (Reno: University of Nevada Press, 1986); Michael Frome, ed., *Wild Nevada: Testimonies On Behalf Of the Desert* (Reno: University of Nevada Press, 2005); William L. Fox, *Playa Works: The Myth of the Empty* (Reno: University of Nevada Press, 2002). William Fox, *The Void, the Grid & the Sign: Traversing the Great Basin*. (Salt Lake City: University of Utah Press, 2000). Samuel G. Houghton, *A Trace of Desert Waters: The Great Basin Story* (Salt Lake City: Howe Brothers, 1986); Ronald Lanner, *The Piñon Pine: A Natural and Cultural History* (University of Reno: Nevada Press, 1981); John McPhee, *Basin and Refuge* (New York: The Noonday Press, 1980); Michael L. Nicklas, *The Great Basin: The Story Behind the Scenery* (Las Vegas, NV: KC Publications, 1996); Wilbur S. Shepperson, *Mirage-Land: Images of Nevada* (Reno: University of Nevada Press, 1992); Dale J. Stevens, ed. *The Great Salt Lake: A Geographic Survey* (Provo: Brigham Young University Press, 1975); Stephen Trimble, *The Sagebrush Ocean: A Natural History of the Great Basin* (Reno: University of Nevada Press, 1989); James Young and Abbot B. Sparks. *Cattle in the Cold Desert* (Reno: University of Nevada Press, 2002).

is “like the bottom of the sink—some might say a toilet bowl.”<sup>14</sup> Early explorers and settlers viewed the area as a place of “barrenness, desolation and dreariness.”<sup>15</sup> In many respects the West Desert was the antithesis of the monumental landscape.<sup>16</sup>

Yet despite common impressions, the West Desert was not an empty wasteland. Humans had inhabited it for thousands of years, and while many colonists dismissed the region as inhospitable and unproductive, many others came to treasure its resources. Most significantly, an industry based on the seasonal grazing of sheep developed and prospered in the West Desert. Nevertheless, the vision of an empty space persisted, often ironically and perversely informing the actions of the people who utilized the area.

Prior to the sheep kill incident, the military and livestock industry had been the dominant social forces in shaping the region.<sup>17</sup> Both had colonized the West Desert in the nineteenth century. Early on they competed over grazing resources, yet by the twentieth century the military’s environmental agenda had radically changed. While livestock operators continued to see the land as a material resource for individual and community prosperity and identity, military interests viewed the West Desert as a vast, outdoor laboratory for experimenting with weapons of mass destruction. The military and livestock industry thus inhabited the same physical space, but not the same conceptual

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<sup>14</sup> Steve Erickson, “US Army Dugway Proving Ground: Basin for Bio-testing” (paper presented at “Biodevastation 7,” held 16-18 May 2003 in St. Louis, MO) reprinted in *Dugway Proving Ground Survivors*, <http://www.project-112shad-fdn.com/erickson.htm> (accessed 19 May 2007).

<sup>15</sup> J.S. Holliday, *The World Rushed In: California Gold Rush Experience*, (New York: Simon and Schuster, 1981) quoted in Patricia N. Limerick, *Desert Passages: Encounters with American Deserts* (Albuquerque: University of Nevada Press, 1985), 18.

<sup>16</sup> For monumental landscapes, see Alfred Runte, *National Parks: The American Experience* (Lincoln, NB: University of Nebraska Press, 1979); For the antithesis of a monumental landscape, see Ann Ronald, “Why They Don’t Write About Nevada,” in *A Wilderness Tapestry: An Eclectic Approach to Preservation* eds. Samuel I Zeveloff, Mike L. Vause, and William H. McVaugh (Reno: University of Nevada Press, 1992), 97-109.

<sup>17</sup> Miners were also present in the West Desert, but, according to historian John Bluth, mining “never brought returns due to distance, low grade ore, and development and operation expense. Almost all mines were marginal, sporadic, and consumed more wealth than they produced.” For further details, see John Fredrick Bluth, “Confrontation with an Arid Land: The Incursion of Gosiutes and Whites into Utah’s Central West Desert, 1800-1978” (PhD Diss., Brigham Young University, 1979), 135.

space.<sup>18</sup> Together they made incompatible concurrent claims to the West Desert. The result was the production of a socially, culturally, politically, economically, and ecologically contested landscape.

Conversely, the military and the livestock industry also had much in common. Both, for example, found value in lands deemed worthless by many, and both were largely self regulated and enjoyed free rein to utilize West Desert resources with little oversight. This lack of accountability, which partly arose from the general lack of interest in the region, resulted in severe environmental consequences that prompted federal intervention. In the end, two conflicting groups of interests collectively committed ecocide, producing a tragically marginalized landscape in an area that had previously supported Native and Euro Americans for generations.

Although the recent trend in environmental history has been to move away from its initial focus on the American West, historian David J. Weber has pointed out that “historians have continued to find new meanings in the western past that have kept it relevant to the interest and concerns of this generation.”<sup>19</sup> One of those ways has been by exploring the tangled relationship between human and ecological history in such hard-used and contested places as the West Desert. Several historians have noted the way that deserts have exposed the difficulty North American society has had in adapting social institutions, laws, agricultural practices, and aesthetic perceptions to arid lands. This maladaptation to deserts is most clearly manifested in the transformation of the West Desert and similar places into national sacrifice zones for dumping, testing, and storing

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<sup>18</sup> This idea is adapted from Hal Rothman’s “Tourism as Colonial Economy: Power and Place in Western Tourism” in *Power and Place in the North American West*, eds. Richard White and John M. Findlay (Seattle: University of Washington, 1999), 180.

<sup>19</sup> David J. Weber, Preface to *Under an Open Sky: Rethinking America's Western Past* eds. William Cronon, George Miles, and Jay Gitlin (New York: W.W. Norton, 1992), x.

extremely hazardous materials.<sup>20</sup> Only a handful of studies have examined why some deserts have become sacrificial spaces. These studies are important, yet they focus primarily on the dramatic developments that reshaped the American West during and after World War II.<sup>21</sup> This study seeks to push that window further back in time to Western settlement and early economic development as well as the critical period around WWII. This will create a more complete picture of the origins of America's largely dysfunctional relationship to arid lands.

The West Desert is also one of the many militarized landscapes in the American West. Environmental historians Richard P. Tucker and Edmund P. Russell have noted how scholars have rarely "considered the ecological consequences of warfare as a central, distinctive element of humans' historically evolving relation to the natural world."<sup>22</sup> Such neglect is even more egregious in the American West, where military developments have been some of the most instrumental social forces shaping ecological change. In focusing on the creation of a national security landscape and the material activities of the military in the West Desert, this study explores vital yet largely neglected issues

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<sup>20</sup> The West Desert has become the epitome of such sacrificial zones, hosting chemical-biological weapons testing, storage, and disposal facilities, an Air Force bombing range, a low-level nuclear waste dump, a hazardous waste incinerator, as well as a magnesium chloride plant that was once labeled as the nation's worst air polluter. For further details, see The Center for Land Use Interpretation, *Points of Interest in the Great Salt Lake Desert Region* (Culver City, CA: The Center for Land Use Interpretation, 2004).

<sup>21</sup> For examples, see Scott Carrier, "The West Desert," *Transom.org*, <http://www.transom.org/shows/2002/200209.westdesert.html> (accessed 21 May 2007); Russell J. Dalton, Paula Garb, Nicholas P. Lovrich, John C. Pierce, and John M. Whitely, eds. *Critical Masses: Citizens, Nuclear Weapons Production, and Environmental Destruction in the United States and Russia* (Cambridge, Mass.: The Massachusetts Institute of Technology Press, 1999). Mike Davis, "Dead West: Ecocide in Marlboro Country," in *Dead Cities and Other Tales* (New York: New York Press, 2002), 33-65; Phillip Fradkin, *Fallout: An American Nuclear Tragedy* (Tuscan: University of Arizona Press, 1989); Valerie L. Kuletz, *The Tainted Desert: Environmental and Social Ruin in the American West* (New York: Rutledge, 1998); Richard Misrarch, *Bravo 20: The Bombing of the American West* (Baltimore: Johns Hopkins University Press, 1990); Seth Shulman, *The Threat at Home: Confronting the Toxic Legacy of the U.S. Military* (Boston: Beacon Press, 1992); Rebecca Solnit, *Savage Dreams: A Journey into the Landscape Wars of the American West* (Berkeley: University of California Press, 1999); Chip Ward, *Canaries on the Rim: Living Downwind in the West* (New York: Verso, 1999).

<sup>22</sup> Richard P. Tucker and Edmund Russell, *Natural Enemy, Natural Ally: Toward an Environmental History of War* (Corvallis, Or: Oregon State University Press, 2004), 1 (quotation), 2, 3, 15. Also, see Edmund Russell, *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring* (Cambridge: Cambridge University Press, 2001) 1-16.

regarding the tensions between national security, economic prosperity, and ecological health. Dugway, moreover, was the main site for chemical and biological weapons (CBW) testing by the U.S Military. The advent of the “war on terror” has given CBW increased significance. Thus it is increasingly necessary to remember the often hidden and unacknowledged social and ecological costs that resulted from previous efforts to defend ourselves against such weapons.<sup>23</sup>

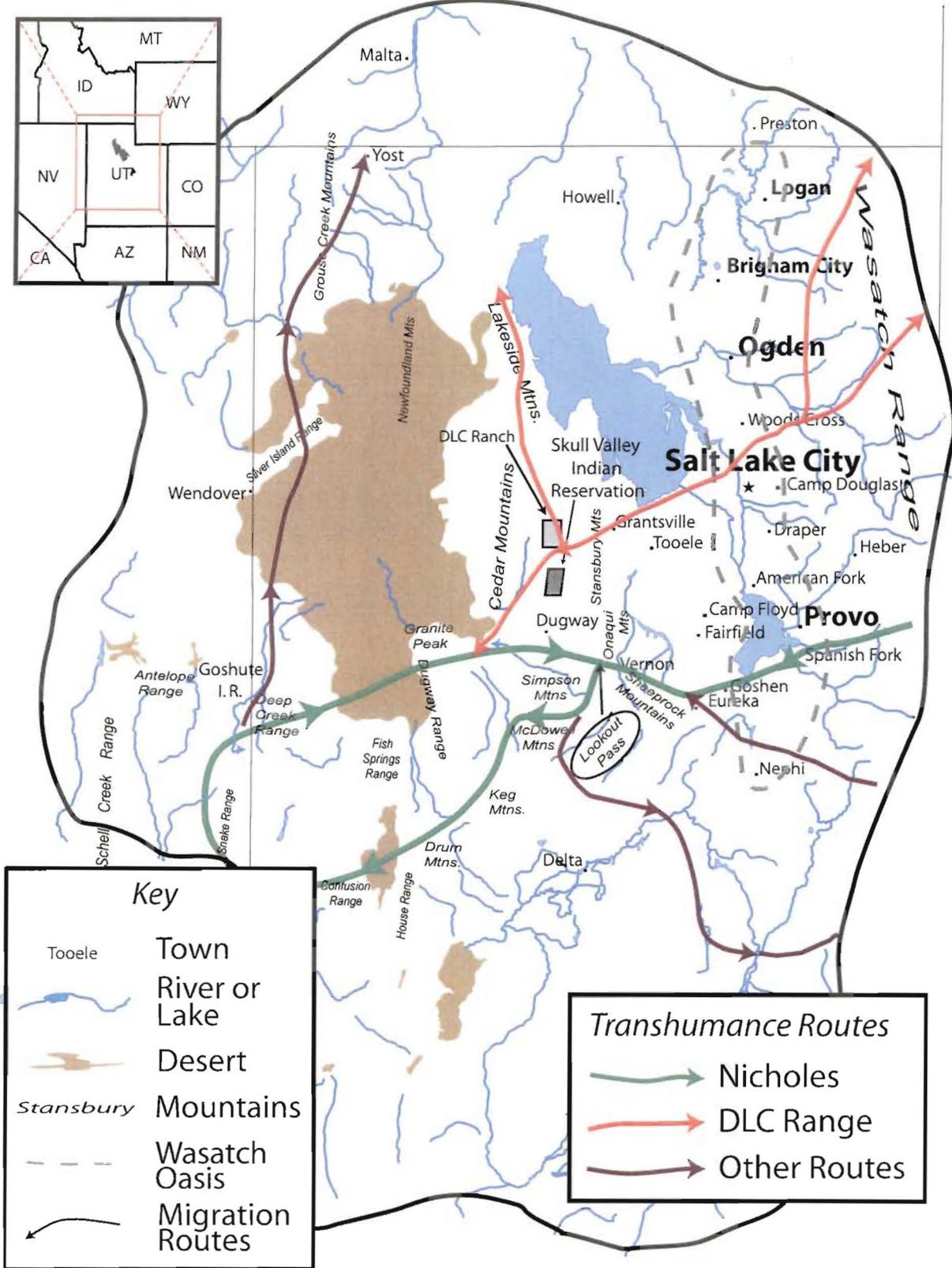
My study will achieve these objectives by tracing the history of the West Desert on several spatial, ideological, and temporal scales, including understandings of the landscape at the regional, national, and international level, tensions between urban and rural as well as national and local visions of the landscape, and how these perspectives shifted over time.<sup>24</sup> The study begins by tracing the rise of the sheep industry in the West Desert and its social and environmental impacts. Chapter two focuses on the friction between pastoral and national security landscapes, detailing how interests in national security and economic prosperity shaped experience and ecology. The final chapter examines how the self-monitored Dugway weapons testing program that was devoted to ensuring national security, instead presented perilous threats to the environment and American public. A brief conclusion brings the study up to the present and traces its broader implications.

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<sup>23</sup> In response to alleged CBW threats by terrorists the U.S. has recently increased funding for biodefense research by over 300% and rejected certain protocols of international biological weapons conventions. These developments have helped Dugway Proving Ground to become a military nerve center not only for biodefense research, but for counterterrorism training as well.

<sup>24</sup> For discussions on the importance of scale in environmental history, see Richard White, “Nationalization of Nature,” *The Journal of American History* 86 (Dec. 1999): 976-986; Alan Baker, *The Geography of History: Bridging the Divide* (Cambridge: Cambridge University Press, 2003), 72-108.

# Map 2: Grazing in the West Desert



**CHAPTER I**  
**PLUNDERING PARADISE:**  
**UNRESTRICTED GRAZING IN THE WEST DESERT**

**Introduction**

The West Desert is one of the most arid and least inhabited regions of North America. The immense and barren salt flats which stretch across much of the region are as striking to modern motorists as they were to the first Euroamerican explorers and settlers to set foot on the land. Yet despite popular conceptions, the West Desert has never been an empty wasteland or even uniformly desert in character. Humans have inhabited it for thousands of years. And while many dismissed the region as inhospitable and unproductive, a few Euroamericans came to treasure its resources. From the 1850s to the early 1930s, an industry based on the seasonal grazing of sheep developed and prospered in the West Desert. The grazing industry made significant economic contributions that shaped the development of communities across the Bonneville Basin, and its success principally relied on sheepherders' ability to freely exploit the West Desert. Largely because sheepherders utilized lands deemed worthless by many, they were able to apply heavy pressure with few encumbrances and little oversight from outside interests for over sixty years.

Thus for grazers the West Desert was never a worthless space. Early on sheep owners regarded the region as a herder's paradise, yet as grazing pressure increased, the quality of forage began to deteriorate. Livestock operators responded by employing a variety of internally-regulated strategies to cope with overcrowding and overgrazing. These strategies worked for many years, from an economic standpoint, but they were not ecologically sustainable. Inexorably, the region's grassland sagebrush communities lost

their ability to support the industry. The effects of unrestricted grazing also endangered local inhabitants, and over time they had the perverse effect of turning the West Desert into a more marginal landscape. The severity of the ecological devastation prompted federal regulatory intervention in the 1930s, which effectively put an end to the unrestricted style of ranching long practiced by sheepherders.

### **Wasteland or Rangeland? Early Perceptions of the West Desert**

Native Americans have lived successfully in the West Desert for thousands of years. Archeological evidence, some of which dates back 11,000 years, suggests that early West Desert inhabitants lived in small nomadic bands of extended families. While these bands did not amass much property, hold complicated rituals, or conduct large-scale building projects, evidence suggests they did practice highly sophisticated subsistence strategies that exploited a variety of local resources. In Danger Cave near Wendover, for example, archeologists found ancient fragments of sixty-eight different plant species that still grow within ten miles of the cave as well as the remains of many local animals.<sup>1</sup> By utilizing such a diverse amount of flora, fauna, and other West Desert resources, these bands are believed to have maintained a consistent and continuous way of life in the region for thousands of years.<sup>2</sup>

The Goshutes, the Native group that inhabited the West Desert when the colonists arrived, similarly practiced complex land-use patterns that employed a variety of subsistence strategies.<sup>3</sup> Pine nuts were their most important food source, but they also

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<sup>1</sup> Paul W. Reeve, "Danger Cave near Wendover Provided Clues to Ancient Utah Dwellers," *Utah History to Go*, [http://historytogo.utah.gov/utah\\_chapters/american\\_indians/dangercaveprovidedcluestoancientutahdwellers.html](http://historytogo.utah.gov/utah_chapters/american_indians/dangercaveprovidedcluestoancientutahdwellers.html) (accessed 24 July 2007).

<sup>2</sup> Reeve, "Danger Cave;" Dave N. Schimitt and David B. Madsen eds., *Camels Back Cave* (Salt Lake City: University of Utah Press, 2005).

<sup>3</sup> James B. Allen and Ted J. Warner, "The Gosiute Indians in Pioneer Utah," *Utah Historical Quarterly* 39 (Spring 1971): 163; Floyd A. O'Neil, "The Utes, Southern Paiutes, and Goshutes," *Utah History to Go*,

gathered eighty-one species of wild vegetables, forty-seven varieties of seeds, twelve berries, eight roots, and many types of insects.<sup>4</sup> They also hunted antelope, deer, rabbits, rodents, and small reptiles.<sup>5</sup> These strategies sustained the hundreds of Goshutes that occupied the West Desert for generations. Yet whereas contemporary Goshute accounts tend to stress the region's natural abundance, early Euro American explorers and settlers found little worth in the West Desert.<sup>6</sup>

Jedediah Smith was the first Euroamerican to explore the West Desert. On 24 June 1827, Smith and a party of trappers headed east from Fish Springs into the low and extremely arid region of what is today Dugway Proving Ground. Suffering greatly from thirst and heat, Smith ascended a hill to scout what lay ahead but discovered that "the view ahead was almost hopeless."<sup>7</sup> The party had no choice but to struggle onward in search of water and recourse from the heat. Over the next few hours one horse gave out and the party had to leave a member behind. In the evening, Smith recorded how the heat was so overbearing that his party "dug holes in the sand and laid down in them for the purpose of cooling our heated bodies." Later they tried to sleep but "tormented nature made us dream of things we had not and for the want of which it then seemed possible, and even probable that we might perish in the desert, unheard of and unpitied [sic]."<sup>8</sup>

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[http://historytogo.utah.gov/people/ethnic\\_cultures/the\\_peoples\\_of\\_utah/theutesouthernpaiutesandgoshutes.html](http://historytogo.utah.gov/people/ethnic_cultures/the_peoples_of_utah/theutesouthernpaiutesandgoshutes.html) (accessed 10 May 2007); David Rich Lewis, "Native Americans in Utah," *Utah History to Go*, [http://historytogo.utah.gov/utah\\_chapters/american\\_indians/nativeamericansinutah.html](http://historytogo.utah.gov/utah_chapters/american_indians/nativeamericansinutah.html) (accessed 24 July 2007).

<sup>4</sup> O'Neil, "The Utes, Southern Paiutes, and Goshutes."

<sup>5</sup> Lewis, "Native Americans in Utah."

<sup>6</sup> For natural abundance, see Ward, *Canaries on the Rim*, 215-216; Steven J. Crum, "The Skull Valley Band of the Goshute Tribe – Deeply Attached to their Native Homeland," *Utah Historical Quarterly* 55 (Summer 1987): 250-267; Steven J. Crum, "Native Americans, the Lehman Caves, and Great Basin National Park," *Nevada Historical Society Quarterly* 48 (Fall 2005): 350.

<sup>7</sup> George Brooks, ed., *The Southwest Expedition of Jedediah S. Smith* (Glendale, Ca: Arthur H. Clark Company, 1997), 186-8; Ouida Blanthorn, *A History of Tooele County* (Salt Lake City: Utah State Historical Society, 1998), 47.

<sup>8</sup> Brooks, *The Southwest Expedition of Jedediah S. Smith*, 186-8; Alson J. Smith, *Men Against the Mountains: Jedediah Smith and the Southwest Expedition of 1826-1829* (New York: The John Day Co., 1965) quoted in George Shaw, "The Great Salt Lake Desert as a Historical Barrier" in Stevens, *The Great Salt Lake*, L1.

Smith survived the episode, as did his understanding of the West Desert as a desolate landscape. Subsequent explorers would build a bleak lexicon to describe this land. Patricia Limerick noted how John C. Fremont had an “arsenal of adjectival abuse” toward the deserts of the Great Basin, including: “forbidding,” “inhospitable,” “desolate,” “bleak,” “sterile,” “dreary,” “savage,” “barren,” “dismal,” “repulsive,” and “revolting.”<sup>9</sup> Later explorers also emphasized the harshness of the West Desert. On an 1859 survey for overland mail routes across the Great Basin, Captain James H. Simpson commented that “the country passed over is as desert a region as I ever beheld, scarcely a spear of grass visible, and in some areas not even, the characteristics of an arid soil, grease wood or sage. In some places the ground is perfectly bare of everything and is smooth and polished as a varnished floor.”<sup>10</sup>

Yet the western Great Basin was perplexing. It embodied undeniable characteristics of a desert landscape, but it showed many other faces as well. Made up of both valleys *and* ranges, the Great Basin’s arid, desert environments were broken by vertical oases. Often until late summer, for example, snow could still be found on mountain peaks that nurtured alpine lakes and perennial streams. Biased as they were by the aridity, even the early explorers acknowledged the Basin’s variegated nature.

Fremont, for example, commented:

It is called a desert, and from what I saw of it, sterility may be its prominent characteristic... but where there is so much snow, there must be streams; and where there is no outlet, there must be lakes to hold the accumulated waters, or sands to swallow them up. In this eastern part of the Basin, containing Sevier, Utah, and the Great Salt lakes, and rivers and

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<sup>9</sup> Limerick, *Desert Passages*, 29.

<sup>10</sup> Jerome Jessop, “Then & Now: Simpson Expedition Played Key Role in Route of Pony Express Trail,” *Tooele Transcript Bulletin*, 16 February 2006, <http://www.tooeletranscript.com/index.php?option=content&task=view&id=10714&Itemid=2> (accessed 2 May 2007).

creeks falling into them, we know there is good soil and good grass, adapted to civilized settlements.<sup>11</sup>

It was these guardedly positive impressions, particularly Fremont's understanding of what geographers later came to label as the Wasatch Oasis, that attracted Mormons to the region.<sup>12</sup> The settlers' first impressions of the valleys adjacent to the Wasatch ranges were generally encouraging regarding their agricultural productivity and suitability for settlement.<sup>13</sup> While they were primarily interested in irrigable farming lands, they also found the region west of their settlement to be highly suitable for grazing livestock.

Parley P. Pratt was the principal individual commissioned by Brigham Young to explore the intermountain region for suitable settlement areas. As the first Mormon to survey the West Desert, he enthusiastically declared that the "supply of pasture for grazing animals is without limit in every direction. Millions of people could live in these countries and raise cattle and sheep to any amount."<sup>14</sup> The next year, Pratt added that the "best foundation for living in this country would be a herd of young heifers, driven from the states, or a drove of sheep.... As a grazing country there is scarce its equal on the globe."<sup>15</sup>

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<sup>11</sup> John C. Fremont, "A Report on the Exploring Expedition to Oregon and North California in the Years 1843-1844," in Donald Jackson and Mary Lee Spence eds., *The Expeditions of John C. Fremont*, Vol. 1 (Urbana: University of Illinois Press, 1970), 702.

<sup>12</sup> For Wasatch Oasis, see Mark Jefferson, "Utah, The Oasis at the Foot of the Wasatch," *Geographical Review* 1 (May, 1916): 346-358; Langdon White, "The Insular Integrity of Industry in the Salt Lake Oasis," *Economic Geography* 1 (July, 1925): 206-235; Thomas G. Alexander, "Stewardship and Enterprise: The LDS Church and the Wasatch Oasis Environment, 1847-1930," *The Western Historical Quarterly* 25 (Autumn, 1994): 340-364. For Fremont's influence on Mormon settlers, see David E. Miller, "Explorer and Trail Blazers," in *Utah's History*, eds., Richard D. Poll et al (Logan: Utah State University Press, 1989), 78.

<sup>13</sup> For further details on Mormon settlers' early perceptions of the Great Basin, see Richard H. Jackson, "Utah's Harsh Lands, Hearth of Greatness," *Utah Historical Quarterly* 49 (Winter 1981); Richard H. Jackson "Mormon Perception and Settlement," *Annals of the Association of American Geographers* 68 (Sep. 1978).

<sup>14</sup> George Stewart, "Historic Records Bearing on Agriculture and Grazing Ecology in Utah," PAM 848, Utah State Historical Society, Salt Lake City, Utah, 370.

<sup>15</sup> Stewart, "Agriculture and Grazing Ecology in Utah," 371.

Under Pratt's and other church leaders' guidance, livestock operators in Salt Lake Valley were encouraged to explore the West Desert.<sup>16</sup> The impetuses for this westward move were varied, but principle among them was that, as historian Quida Blanthorn notes, "with the increasing influx of people and livestock into Salt Lake Valley, nearby grazing land soon became overgrazed and in danger of being depleted." By fall 1848 settlers "were pushing west into Tooele Valley to graze their animals."<sup>17</sup>

Established by a small group of Mormons in the winter of 1849-1850, Tooele became one of the few large Mormon settlements in the West Desert. Located on the eastern side of Tooele Valley at Settlement Creek, early settlers farmed hay and other grain, ran gristmills and sawmills, and built up large herds of sheep and cattle.

Livestock operators found exceptional forage in Tooele Valley. Phillip Francis De Lamare, who arrived in the 1850s, "often related that on his arrival in Tooele as a boy he remembered a valley full of high waving grass, a veritable herder's paradise, and ...it was not an uncommon happening for stockmen to be unable to find their animals because of being lost in this high grass which spread over the valley."<sup>18</sup> Federal surveyor Captain Howard Stansbury similarly noted that the area "forms an excellent pasturage for numerous herds of cattle wintered here by [the Mormons] under the charge of keepers. The grass is very abundant and numerous springs are found on both sides of [the valley]."<sup>19</sup>

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<sup>16</sup> For details on the Mormon Church's role in encouraging livestock operators to move to the West Desert, see Howard J. Clegg, "Agricultural History of Tooele" in *History of Tooele County*, ed. Orrin P. Miller, Vol. II (Tooele: Tooele Transcript Bulletin, 1990), 156-158. For a family history of this movement to the West Desert, see Glynn Bennion, "A Pioneer Cattle Venture of the Bennion Family," *Utah Historical Quarterly* 35 (Winter 1967): 559-569.

<sup>17</sup> Blanthorn, *A History of Tooele County*, 63-64.

<sup>18</sup> "Philip Francis De LaMare Obituary," *The Tooele Transcript Bulletin*, 19 February 1942 quoted in Walter P. Cottam, "Is Utah Sahara Bound?" *University of Utah Bulletin* 37 (Feb. 1947): 11.

<sup>19</sup> Howard Stansbury, *Exploration Survey of the Valley of Great Salt of Utah* (Washington D.C., 1852) quoted in Cottam, "Is Utah Sahara Bound?," 11.

The movement of livestock into Tooele Valley was gradual, but by the 1860s operators had stocked all of the local areas to such a degree that the quality of forage began to deteriorate. This development led many stock raisers to search for better forage in neighboring regions to the west and south.<sup>20</sup> As in Tooele Valley, owners found these areas to be rich in forage. John Bennion, moved from Tooele Valley to southern Rush Valley with his family in the early 1860s. He described the productivity of these lands to his in-laws in Wales:

About one year ago I with a few others took a few days journey in a South West direction beyond the settlements in search of better grasin [sic] country soon after I moved my sheep cattle & horses out there, I am now well satisfied that it was a move in the right direction, our livestock wintered well, by getting their own living, I now have a flock of 1150 sheep about 70 of cattle and about 20 head of horses.<sup>21</sup>

As in Tooele Valley, however, the forage in neighboring valleys began to deteriorate from the pressure of heavy grazing. Glynn Bennion, the grandson of John Bennion, noted that his family and their neighbors “ran 10,000 head of cattle, hundreds of horses and two large herds of sheep.”<sup>22</sup> However, by 1875 the

range was so badly depleted that cows were calving only every other year, and both cattle and sheep were being moved in the fall to winter in the lower valleys farther west. As Uncle Hyrum put it, ‘when we first came to the south end of Rush Valley in 1860 we thought it was the best range in Utah, because we could stay in one place all year round. But by 1875 it was all et [sic] out, and we had to move our cattle to Castle Valley.’<sup>23</sup>

Bennion regarded his family’s movement from Salt Lake Valley to Tooele Valley to Rush Valley as the “history of western grazing in a nutshell. The pioneers found splendid

<sup>20</sup> For a discussion on the deterioration of Tooele grasslands, see Clegg, “Agricultural History of Tooele,” 156.

<sup>21</sup> Ruth Winder Rogers ed., *Bennion Family History* 4 (Bennion Family Association, 1990), 136 quoted in John Bennion, “The Chimerical Desert” *BYU Studies* 32 (Fall 1992): 29-31.

<sup>22</sup> Glynn Bennion, “Some Things I have Read, Heard, and Seen Relating to Range Use in Utah” *Works Progress Administration (Utah Section) “History of Grazing” Notes, 1940-1941*, Mss B 100, Box 3, Folder 8, Utah State Historical Society, Salt Lake City, Utah, 5.

<sup>23</sup> Glynn Bennion, “A Pioneer Cattle Venture of the Bennion Family,” 563.

feed everywhere when they arrived in the Great Basin and proceeded to cash in on it as fast as they could. When one valley was denuded they hunted a virgin range.”<sup>24</sup>

### **The U.S. Military in the West Desert, 1840s to 1860s**

Glynn Bennion’s assessment of the history of grazing may have been apt, but, like many historians, he neglected the role of the U.S. military in shaping the West Desert. After all, it had been the military that for the most part had to subdue Native Americans in the intermountain region, thus opening valuable grazing lands to settlers. Yet the military also challenged settlers for these lands and, in some cases, forced civilian livestock operators to depart.

The military’s interest in the West Desert began in the 1840s and 1850s with the early surveys of Major General John C. Fremont, Captain Howard Stansbury, Lieutenant John W. Gunnison, and Lieutenant Colonel Edward J. Steptoe. Steptoe arrived in the territory in August 1854 to investigate the Gunnison Massacre. He set aside a military grazing reserve in northern Rush Valley, near present-day Stockton.<sup>25</sup> Four years later, Colonel Sidney Albert Johnston, commander of the 1857-1858 Utah Expedition, established Camp Floyd in Cedar Valley, which is an area lying between the Oquirrh and Lake Mountain ranges, two of the Great Basin’s last easterly ranges before the Wasatch Oasis, directly west of Provo’s Utah Lake.

Many reasons have been given for the so-called Utah War that brought Johnston’s federal troops into the then largely autonomous Mormon settlements in the Bonneville Basin. These include a federal aversion to polygamy, an alleged Mormon rebellion, and

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<sup>24</sup> Glynn Bennion, “Lets Stop Kidding Ourselves (Sow Sheep Manure—and Reap the Dust),” *Works Progress Administration (Utah Section) “History of Grazing” Notes, 1940-1941*, Mss B 100, Box 3 Folder 9, Utah State Historical Society, Salt Lake City, Utah, 4.

<sup>25</sup> Blanthorn, *A History of Tooele County*, 58; Charles S. Peterson, “Grazing in Utah: A Historical Perspective,” *Utah Historical Quarterly* 57 (Fall 1989): 302.

even a tactical diversion of troops on the eve of the Civil War.<sup>26</sup> Whatever the reason, Camp Floyd quickly became one of the largest U.S. Military installations in the American West. By 1859, it and the adjacent civilian town of Fairfield supported over 7,000 inhabitants, making it Utah Territory's third largest city and the largest settlement in the West Desert.<sup>27</sup>

Mormon settlers regarded these troops as a threat to their autonomy, yet many, including non-Mormon settlers, also recognized that the military camp was an economic asset to the region. Estimates of the expedition's cost to the U.S. government range between \$14 million and \$40 million.<sup>28</sup> Utah settlers absorbed a significant fraction of these funds. One observer from the military noted, for example, how "the breaking up and withdrawal of the Johnston army from Camp Floyd ...have given such fine markets for their abundant surplus as to have made [the Mormons] in the aggregate very wealthy."<sup>29</sup> One Mormon settler agreed, remarking smugly: "Cattle cheap and money plentiful. The bullets the troops brought to shoot at us turned out to be gold Eagles and landed in our pockets."<sup>30</sup> The military boom was significant, especially considering how

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<sup>26</sup> William P. Mackinnon, "125 Years of Conspiracy Theories: Origins of the Utah Expedition of 1857-1858," *Utah Historical Quarterly* 52 (Summer 1984).

<sup>27</sup> According to Thomas G. Alexander, from 1858 to 1859 the number of soldiers at Camp Floyd averaged more than 2,400, and at times the number exceeded 3,000. A monument at the historic site claims that this was the biggest aggregation of federal troops in the U.S. prior to the Civil War and other sources note how the troops stationed at Camp Floyd encompassed one-third of the U.S.'s Armed Forces at the time. For further details, see Thomas G. Alexander and Leonard J. Arrington, "Camp in the Sagebrush: Camp Floyd, Utah 1858-1861," *Utah Historical Quarterly* 34 (Winter 1966): 9, 13; Mackinnon, "125 Years of Conspiracy Theories," 213. For a broader perspective of the U.S. Military's presence in Western North America between the Mexican-American War and the Civil War, see Durwood Ball, *Army Regulars on the Western Frontier 1848-1861* (Norman, Ok: University of Oklahoma, 2001).

<sup>28</sup> Mackinnon, "125 Years of Conspiracy Theories," 213.

<sup>29</sup> Letters of Major General M. B. Hazen to John Bidwell, Jefferson Barracks Missouri, February, 1867, U.S. Congress, House, 39<sup>th</sup> cong., 2<sup>nd</sup> sess, 1866-67, House Misc. Doc, 75 Serial 1302, 3 quoted in Thomas G. Alexander and Leonard J. Arrington, "The Utah Military Frontier, 1872-1912 Forts Cameron, Thornburgh, and Duchesne" *Utah Historical Quarterly* 32 (Fall 1964): 331.

<sup>30</sup> William Laud, "Diary," Manuscript Section, Church of Jesus Christ of Latter-day Saints, Salt Lake City quoted in Donald R. Moorman, *Camp Floyd and the Mormons: The Utah War* (Salt Lake City: University of Utah Press, 2005), 260.

settlers had recently suffered widespread famine due to a harsh winter, failed harvests, and an influx of poor settlers.<sup>31</sup>

Many inhabitants of Utah Territory reaped the economic benefits of the military's presence, but these alone did not completely ease tensions between the military and the Mormons, two groups who were after all supposed to be at war with each other. Control of grazing lands was one particular source of friction.<sup>32</sup> Cedar Valley did not offer enough forage to support the amount of livestock raised by Camp Floyd's large number of troops.<sup>33</sup> Mormon settlers had grazed livestock in areas surrounding Cedar Valley for a number of years prior to the establishment of Camp Floyd. Johnston was aware that Mormon titles to the land had yet to be settled, which meant the U.S. government still owned all of the land in Utah territory.<sup>34</sup> In need of grazing land, Johnston freely practiced what he saw as the military's land annexation rights to a number of neighboring regions around Cedar Valley.<sup>35</sup>

In the spring of 1859, Johnson ordered settlers to remove their cattle from Rush Valley. This ignited a number of conflicts with civilian livestock operators. On 22 March 1859, for example, local settler Howard Spencer visited Rush Valley to inspect the well-being of his uncle's livestock.<sup>36</sup> There he confronted Sergeant Ralph Pike and a detachment of troops from Camp Floyd who were guarding a new post established "for

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<sup>31</sup> For famine, see Edward W. Tullidge, *The History of Salt Lake City and its Founders* (Salt Lake City, Edward W. Tullidge, [1886]), 246-247; For further information about the economic windfall brought by the arrival of the U.S. Military, see Alexander, "Camp in the Sagebrush," 7-9, 16-19; Moorman, *Camp Floyd and the Mormons*, 260-271; Ball, *Army Regulars on the Western Frontier*, 166, 170.

<sup>32</sup> Alexander, "Camp in the Sagebrush," 13-17.

<sup>33</sup> Norman F. Furniss, *The Mormon Conflict, 1850-1859* (New Haven: Yale University Press, 1960), 223; Alexander, "Camp in the Sagebrush," 13-14;

<sup>34</sup> Norman F. Furniss, *The Mormon Conflict*, 223; Alexander, "Camp in the Sagebrush," 14.

<sup>35</sup> Alexander, "Camp in the Sagebrush," 13-15.

<sup>36</sup> Alexander, "Camp in the Sagebrush," 13-15; Furniss, *The Mormon Conflict*, 223-226; Hal Schindler, "Is That You Pike? Feud between Settlers, Frontier Army Erupts and Simmers for Three Decades," *Salt Lake Tribune*, 2 June 1995, [http://historytogo.utah.gov/salt\\_lake\\_tribune/in\\_another\\_time/070295.html](http://historytogo.utah.gov/salt_lake_tribune/in_another_time/070295.html) (accessed 10 May 2007).

the purpose of protecting from thieves, a herd of cattle and mules, belonging to the government.”<sup>37</sup> There are varying accounts as to what occurred during the confrontation, but nearly all agree that Howard Spencer, with a pitch fork in hand, caught a near fatal blow to the head from the butt of Pike’s rifle.<sup>38</sup>

The incident caused much agitation within the territory, and four months later Pike was brought to trial on charges of assault with intent to kill. One afternoon during a court recess, Pike was walking to his quarters in Salt Lake City, when he met Howard Spencer, who “deliberately shot Pike through, and through the body with the bullets of his revolver.”<sup>39</sup> The official Mormon newspaper partly vindicated the murder, saying:

We do not approve of the act, but if it shall finally be made to appear, that young Spencer was the murderer, there are many no doubt, who will justify the deed, and laud the bravery of a lad, who thus avenged the wrong that had been committed upon him without provocation.<sup>40</sup>

The Pike-Spencer affair was not an isolated incident. Friction over grazing land between civilian and military livestock operators also occurred in Skull and Tintic Valleys as well as in Juab and Sanpete counties to the south.<sup>41</sup> At the center of such conflicts was access to resources. The military claimed a legal right to West Desert grazing lands, while local settlers believed they possessed a preemptive right to land they had grazed for years.<sup>42</sup> These assumptions led the military to view civilian livestock operators as potential “thieves” of government property and, conversely, Spencer and his supporters to believe that they were justified in protecting their livelihoods. The Pike-

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<sup>37</sup> Alter J. Cecil and Robert J. Dwyer, eds., “Journal of Captain Albert Tracy, 1858-1869,” *Utah Historical Quarterly* 13 (1945): 72.

<sup>38</sup> For further details on this incident, see Furniss, *The Mormon Conflict*, 223-227; Hal Schindler, “Is That You Pike?”; Alexander, “Camp in the Sagebrush,” 13-15.

<sup>39</sup> Cecil, “Journal of Captain Albert Tracy,” 73.

<sup>40</sup> *Deseret News*, 17 Aug 1859 quoted in Furniss, *The Mormon Conflict*, 225.

<sup>41</sup> Alexander, “Camp in the Sagebrush,” 13.

Spencer incident thus highlighted a hierarchy of environmental power in the West Desert.<sup>43</sup> Although both sides claimed the same environmental resources, military needs and federal sovereignty took precedence over local interests. The nature of this conflict in the late 1850s revealed a pattern of social and environmental dispossession from military occupation that would be repeated in the twentieth century. During the nineteenth century, however, the influence of the military waxed and waned.

Although Camp Floyd was short lived--in 1861 the last troops were called east by the outbreak of the Civil War--the military's departure from the region was only temporary. In 1862, Colonel Patrick Edward Connor was given orders to reestablish Camp Floyd to secure the overland mail route in the intermountain region. When Conner arrived with 700 members of the California volunteer infantry in September of 1862, most buildings were in ruins and the local supply of timber had been exhausted. Convinced that Mormon settlers were "a community of traitors, murderers, fanatics, and whores," Conner relocated the camp to a more strategic and authoritative position.<sup>44</sup> The new site was directly above Salt Lake City on the eastern bench of the Wasatch Mountains. In Conner's official report on the founding of Camp Douglas, he noted how the camp's location:

commands a full view of the city and the Great Salt Lake.... If it is contemplated to establish a permanent post in this Territory I know of no spot so desirable as this.... it is the center from which diverge three roads to California, two to Oregon, and the great Overland Mail Route to the

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<sup>42</sup> For a discussion of the idea of a moral ecology, see Karl Jacoby, *Crimes against Nature: Squatters, Poachers, Thieves, and the Hidden History of American Conservation* (Berkeley: University of California Press, 2001), 3.

<sup>43</sup> The notion of a hierarchy of environmental power is adopted from Andrew Hurley's *Environmental Inequalities: Class, Race, and Industrial Pollution in Gary, Indiana, 1945-1980* (Chapel Hill: University of North Carolina Press, 1995), 2.

<sup>44</sup> Connor to Drum, 14 Sept. 1862 in *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*, eds. George W. Davis, Leslie J. Perry, and Joseph W. Kirkly, Series I, Vol. L, Part 2, (Washington, D.C., 1897), 199; Also quoted in Leonard J. Arrington and Thomas G. Alexander, "The U.S. Army Overlooks Salt Lake Valley: Fort Douglas 1862-1965," *Utah Historical Quarterly* 33 (Fall 1995): 326, 328.

east. The low price of forage for animals is an additional advantage which it possesses....<sup>45</sup>

Conner's choice appealed to military interests. Camp Douglas became a permanent military installation in the intermountain region that served a variety of functions over the next century. During the nineteenth century, the camp was a base of operations to combat what was commonly labeled as the "Indian problem." Connor's mission to protect the overland mail route led him into many conflicts with Native Americans across intermountain region; most notoriously he massacred more than 300 Shoshones near the Bear River in Cache Valley on 23 July 1863.

Such violence was less common in the West Desert. Newly established civil and military settlements had encroached upon favored Goshute lands. Mormons settlers appropriated valuable spring water and their livestock ate up scarce West Desert food resources, leaving the Goshutes with few options for sustenance. By the 1860s, the Goshutes were compensating for their losses by raiding the overland mail route and settler's property, particularly livestock.<sup>46</sup> To alleviate this problem, the federal government negotiated a series of treaties with the Goshutes in 1863, offering them incentives to cease hostile activities against the settlers and encouraging them to "abandon the roaming life" and "become settled as herdsmen or agriculturists."<sup>47</sup> With these and other measures, hostilities between Goshutes and settlers declined, and the Goshutes, according to historians James B. Allen and Ted J. Warner, "apparently settled down in an effort to make a success of farming in Deep Creek and Skull Valley."<sup>48</sup>

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<sup>45</sup> Davis, *War of the Rebellion*, 218.

<sup>46</sup> For further details on these raids, see Allen, "The Gosiute Indians in Pioneer Utah," 164; O'Neil, "The Utes, Southern Paiutes, and Goshutes."

<sup>47</sup> U.S. *Statutes at Large*, 13 stat. 681-84 (1866) quoted in Allen, "The Gosiute Indians in Pioneer Utah," 168.

<sup>48</sup> Allen, "The Gosiute Indians in Pioneer Utah," 171.

### **The Sheep Boom and the Development of Transhumance in the Bonneville Basin**

Although relations with the Goshutes remained unstable, during the 1860s efforts by federal officials and Mormon settlers to subdue Native Americans in the Bonneville Basin were largely effective.<sup>49</sup> By the 1870s, threats posed to livestock had declined to the point that operators felt secure enough to penetrate further west into the vast grazing lands.<sup>50</sup> The Bennions were some of the first livestock operators to test these newly “opened” lands. In November 1874, Israel Bennion, aged 15, and David Bennion, aged 11, led a band of 5,000 sheep through Lookout Pass, near the southwestern end of Rush Valley, into the low and arid valleys and playas of the West Desert. Glynn Bennion, son of Israel, recounted how all “winter the boys wandered with their herd, lost in the vast spaces and melancholy silence of the desert, seeing no one, sending no messages, until they returned, themselves and their sheep all in good order, back through Lookout Pass the following May.”<sup>51</sup> As in the Salt Lake, Tooele, and Rush Valleys, grazing conditions farther west were rich in forage. Israel discovered “the low places of desert to be rich with nuttall salt bush and the slopes white and knee-deep with rice grass, white sage, and curly grass.”<sup>52</sup> The Bennion’s remarkable journey may not have been the first herding of sheep on the arid lowlands of the West Desert, but their journey helped to ensure that

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<sup>49</sup> Tensions between settlers and Natives Americans culminated in what is referred to as the Black Hawk War which lasted from 1865 to 1868. Central to this “war” was the issue of livestock raiding. Many Mormon towns were attacked and abandoned during the period and many Natives Americans were killed indiscriminately. In the fall of 1867 a Ute leader by the name of Black Hawk made peace with the Mormons. Without his leadership the Native American forces, which never operated as a combined front, fragmented even further. The war's intensity decreased and a treaty of peace was signed in 1868. For further details, see Mayland, “Economic Geography of Utah's Sheep Industry,” 100-102. John A. Peterson, “Black Hawk War” *History Utah Encyclopedia*, <http://www.media.utah.edu/UHE/b/BLACKHAWKWAR.html> (accessed 10 May 2007).

<sup>50</sup> Mayland, “Economic Geography of Utah's Sheep Industry,” 100-102.

<sup>51</sup> Glynn Bennion, “Let’s Stop Kidding Ourselves,” 1.

<sup>52</sup> Glynn Bennion, “Range Use in Utah,” 7.

winter grazing in the region spread rapidly.<sup>53</sup> By the 1890s, the West Desert's valleys and ranges teemed with sheep.

There were a number of reasons why West Desert grazers preferred sheep to cattle, but the most influential factor was the Bonneville Basin's unique geographic potential.<sup>54</sup> East of the West Desert lie the Middle Rockies, which stretch from Idaho and Wyoming through central and eastern Utah, making up the Wasatch, Uintah, and Sanpete mountain ranges. These received up to forty inches of annual precipitation. Snowed in and inaccessible during the winter, they offered ideal grazing forage in the summer. To the west lay the low, arid valleys and ranges of the West Desert. These areas received enough snow for sufficient winter forage.<sup>55</sup> The desert and montane zones were from 75 to 300 miles apart. With their durable hooves and agile legs, sheep were better suited to make such long and often precipitous semi-annual treks.<sup>56</sup> Sheep also required less water and, unlike cattle, could slake their thirst by eating snow. Thus sheep were uniquely adapted to both the arid winter environments of the West Desert, where 60 percent of all precipitation comes from snow, and summertime alpine areas.<sup>57</sup>

Mandates from the Mormon Church and tax incentives from the territorial government also influenced livestock operators' preference for sheep.<sup>58</sup> By the 1890s, moreover, much of the irrigable farmland along the Wasatch Oasis had been claimed, yet the region's population continued to expand, leading many young Mormons to search for

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<sup>53</sup> Glynn Bennion, "Range Use in Utah," 7.

<sup>54</sup> White, "Transhumance in the Sheep Industry," 414.

<sup>55</sup> White, "Transhumance in the Sheep Industry," 415, 424; Mayland, "Economic Geography of Utah's Sheep Industry," 66-84.

<sup>56</sup> Wylie D. Goodsell and Marcie Belfield, "Costs and Returns, Migratory-Sheep Ranches, Utah-Nevada, 1972," L. Tom Perry Special Collections Library, Harold B. Lee Library, Brigham Young University, Provo, 1

<sup>57</sup> Denton, *People of the West Desert*, 5.

<sup>58</sup> Mayland, "Economic Geography of Utah's Sheep Industry," 65, 103; White, "Transhumance in the Sheep Industry," 420.

new opportunities. Sheepherding was a profitable, affordable, and socially encouraged choice.<sup>59</sup>

Together, these various factors all contributed to what may be called a sheep boom in the Bonneville Basin. The increase in sheep numbers best illustrates the nature of this boom. In the 1870s, herds in the Bonneville Basin region were estimated at around 60,000.<sup>60</sup> According to historian Charles S. Peterson's careful analysis of census data, the territory was supporting around 1 million head in 1885, and by 1890 the count had jumped to about 1.5 million head. By 1900 the total jumped to 3,818,000.<sup>61</sup> By 1905, numbers had declined by one million, partly due to a scabies epidemic.<sup>62</sup> The downward trend continued until 1920, when flocks again increased, reaching a new peak of over three million by 1930.<sup>63</sup> By then the sheep industry had become an integral component of the regional economy. A 1928 study on sheep ranching, for example, estimated the 1925 total value of all crops in the state of Utah at \$23,603,000 and the value of all cattle at \$14,521,000. The value of sheep, on the other hand, was estimated at \$26,063,000 and profits from their wool added another \$7,400,000.<sup>64</sup> The sheep industry thus contributed nearly 47 percent of all agricultural revenue in the region in 1925.

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<sup>59</sup> Peterson, "Grazing in Utah," 314.

<sup>60</sup> Mayland, "Economic Geography of Utah's Sheep Industry," 96; Peterson, "Grazing in Utah," 305-306.

<sup>61</sup> Peterson, "Grazing in Utah," 305-306. Most of these sheep were located in or adjacent to the West Desert. Langdon White concluded in his 1926 study that over 90% of the sheep along the Wasatch Oasis utilized winter grazing resources in the West Desert, see White, "Sheep Industry of the Salt Lake Region," 420; Range scientists George Stewart also estimated in 1940 that 90% of Utah's sheep operated on a seasonal range basis in the West Desert. For further details, see George Stewart, "Economic Importance of Range Lands," 16 October 1940, *Works Progress Administration (Utah Section) "History of Grazing Notes, 1940-1941*, Mss B 100, , Box 3, Folder 9, Utah State Historical Society, Salt Lake City, Utah; Mayland, "Economic Geography of Utah's Sheep Industry," 97.

<sup>62</sup> Peterson, "Grazing in Utah," 305-306. For further details on the scabies epidemic, see James Moss, "The Deseret Live Stock Company, 1891-1933" (MA Thesis, Brigham Young University, 1965), 87-88; Jean Ann McMurrin, *The Deseret Live Stock Company: A Brief History, 1891-1991* (Woodruff: Deseret Land and Livestock Company, 1991), 7-8.

<sup>63</sup> Peterson, "Grazing in Utah," 305-306.

<sup>64</sup> A.C. Esplin et al, "Sheep Ranching in Utah," *Utah Agriculture Experiment Station Bulletin* 204 (Logan: *Utah Agriculture Experiment Station*, 1928), L. Tom Perry Special Collections Library, Harold B. Lee Library, Brigham Young University, Provo, 13.

The importance of herding in the Bonneville Basin was also reflected in the development of sheep towns, which dotted the map between summer and winter ranges along the Wasatch Oasis. Goshen, Nephi, Mt. Pleasant, Vernon, Spanish Fork, American Fork, Lehi, Draper, Riverton, Woods Cross, Layton, Brigham City, Hyrum, Franklin, and Preston, as well as the Goshute settlements in Skull Valley and near the Deep Creek Mountains, all depended on the sheep industry. According to Peterson, these towns became “hinges upon which the summer winter rhythms turned as sheep trailed from desert to mountain and back.”<sup>65</sup> Many residents were tied to the sheep industry. In Draper, for example, 39 of its 257 inhabitants were shepherders in 1900, but they were hardly the only ones to profit from the sheep industry.<sup>66</sup> Inhabitants often specialized in services related to shepherding operations, such as shearing, dipping, and freighting. The Goshutes at the Deep Creek settlement sheared nearly all the sheep along the central border between Utah and Nevada.<sup>67</sup> In American Fork, several banks catered specially to local herders. A system of credit and other financial services was supported by the sheep economy across the intermountain region.<sup>68</sup>

Shepherders were the core of the industry, though, and in the years following the Bennion brothers’ entry into the West Desert lowlands, a distinct pattern of transhumance developed.<sup>69</sup> Sydney Nicholes herded sheep on the West Desert from 1902 to 1958.<sup>70</sup> Most of this time he trailed his own sheep on public lands, but also worked for other

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<sup>65</sup> Peterson, “Grazing in Utah,” 314.

<sup>66</sup> Peterson, “Grazing in Utah,” 314.

<sup>67</sup> Clel Georgetta, *Golden Fleece in Nevada* (Reno: Venture Publishing Company, 1972), 510.

<sup>68</sup> Bank of American Fork, “Meet Bank of American Fork,” <http://www.bankaf.com/about/history.cfm> (accessed 24 April 2007); Delbert Chipman interview by John Bluth, 5 June 1974, transcript, Simpson Springs Oral History Project, MSS OH 57, L. Tom Perry Special Collections Library, Harold B. Lee Library, Brigham Young University, Provo, Utah, 19.

<sup>69</sup> Bluth “Confrontation with an Arid Land,” 142-145.

herding operations. Nicholes' experiences thus illustrate the lifestyle of an average herder in the Bonneville Basin. From his accounts, moreover, we can gain insight into the typical herding patterns practiced in the West Desert. Nicholes' summer range was in the Wasatch Mountains east of Utah Valley. In late October or early November, he trailed sheep down Spanish Fork Canyon and across the Wasatch Oasis to the town of Goshen.<sup>71</sup> To journey from the mountains to the desert usually took herders one to three weeks, and, because grazing land was more restricted around farming settlements, herders tended to follow similar paths across the Wasatch Oasis, creating crowded and overgrazed conditions.<sup>72</sup> From Goshen, Nicholes continued westward into Rush Valley, where he and many other herders would take their sheep over Lookout Pass to watering areas at Judd Creek or Government Creek in the present-day Dugway Proving Ground.<sup>73</sup>

Winter precipitated another set of seasonal movements. When enough snow had accumulated on nearby ranges, sheepherders left the low-lying creeks for Keg or Simpson Mountains to "snow the sheep." Over the next couple months they gradually trailed flocks westward, leap-frogging from mountain range to mountain range--from Keg Mountain to the Dugway, Swasey, Confusion, and Burbank mountains in the south, usually going as far as the Snake Range in eastern Nevada.<sup>74</sup> These movements were not linear. Nicholes instead "followed the moisture." If, for example, the valley floors were dry he went "right into the top of those mountains... [to] stay there for weeks at a time in that snow." Conversely, if it snowed in the valleys, he would "drop back down on the

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<sup>70</sup> Sidney W. Nicholes Jr. interview by John Bluth, 14 & 16 May 1974, transcript, Simpson Springs Oral History Project, MSS OH 359, L. Tom Perry Special Collections Library, Harold B. Lee Library, Brigham Young University, Provo, U.

<sup>71</sup> Nicholes, 41.

<sup>72</sup> White, "Sheep Industry of the Salt Lake Region," 425; Esplin, "Sheep Ranching in Utah," 18.

<sup>73</sup> Nicholes, 79, 42; Bluth "Confrontation with an Arid Land," 144.

<sup>74</sup> Nicholes, 42; Bluth "Confrontation with an Arid Land," 144.

shad [shadscale] and the lower sage... [and] gather all of the low feed.”<sup>75</sup> Winter fat (*Ceratoides lanata*), bud-sage (*Artemisia spinescens*), and galleta grass (*Pleuraphis jamesii*) yielded the best forage in the West Desert, though sheep could also feed on other varieties of sagebrush as well as modest amounts of shadscale (*Atriplex confertifolia*) and greasewood (*Sarcobatus vermiculatus*).<sup>76</sup> The trail was far from set. Nicholes readily adapted to daily weather conditions, to seasonal variations in feed, to other herders actions, and, most importantly, to the snowline.<sup>77</sup> “As your moisture goes back,” Nicholas noted, “you follow your stuff and come back out of deep snow and follow it back down. You cover it all.”<sup>78</sup>

By the time Nicholes’ and his tender reached the ranges of Nevada, it was well into winter. Herders then turned north in the Snake Range and back east toward the Deep Creek and Fish Springs Mountains. By early spring they were back in the Dugway ranges and an area called the Old River Bed, where Nicholes and many other herders would find “sinks” that held water from winter run-off.<sup>79</sup> From here Nicholes made his way back to Government Creek and then over Lookout Pass into Rush Valley in early April, where he would wait for his “date” at a corral for spring shearing. Nicholes then journeyed back across the Wasatch Oasis to Wasatch Mountains for the summer. From 1902 to 1958, Nicholes never missed a season of herding. The work sustained him and his family, but it was anything but easy. Based in American Fork, his wife was always lonely, and he never had many friends in town or owned much land.<sup>80</sup>

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<sup>75</sup> Nicholes, 42-43, 67.

<sup>76</sup> White, “Sheep Industry of the Salt Lake Region,” 420.

<sup>77</sup> Nicholes, 42-43, 67; Bluth “Confrontation with an Arid Land,” 143-144.

<sup>78</sup> Nicholes, 42-43, 67 (quotation).

<sup>79</sup> Nicholes, 42-43, 68; Chipman, 35; Bluth “Confrontation with an Arid Land,” 144.

<sup>80</sup> Nicholes, 50, 42.

Few herders followed the exact path as Nicholes, but the basic herding strategy of following the moisture, according to historian John Bluth, became a “ritualized” practice employed by shepherders from Cedar City in southern Utah to Idaho to eastern Nevada.<sup>81</sup> Largely because “there was nobody ever on the range, only the livestock and sheepmen or cattlemen that used it”, herders had unobstructed access to grazing resources for more than half a century.<sup>82</sup> Livestock operators with no private land and little capital were able to utilize these resources and build up flocks for a decent living. Each operator worked on a small scale, but as a whole they created an industry that diversified the regional economy and helped to sustain rural communities, providing food, clothing, and income to thousands of families. The basis of this freelance industry, though, was the herders’ ability to “follow the moisture,” to freely utilize grazing resources by readily adapting to daily weather conditions, seasonal variations of feed and water resources, and to the actions of other herders. Such flexibility allowed herders to “feed right on across the desert” in every direction and cover “every part of it.”<sup>83</sup>

### **Competition over Diminishing Grazing Resources**

Maintaining this freelance industry was a challenge. Many herders utilized the West Desert. Some owned haying land, but most did not. Some had herded for many years, and others were newcomers that land owners called “tramps.” Summer and winter ranges were on public lands, and there were no formal laws governing herding practices. These were the conditions for opportunity, but they also encouraged overcrowding and overgrazing. To combat the effects of overuse, sheepherders adopted a number of

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<sup>81</sup> Bluth, “Confrontation with an Arid Land,” 145. For details on Nevada sheepherders utilizing the West Desert, see Georgetta, *Golden Fleece in Nevada*; Paris Beltran and William Douglas, *Beltran: Basque Sheepmen of the American West*, (Reno: University of Nevada Press, 1979).

<sup>82</sup> Nicholes, 86.

<sup>83</sup> Nicholes, 83, 67.

internally-regulated strategies. Early on the most common strategy was to expand to new ranges, but by the 1890s there were no new lands left to exploit. One common practice after the 1890s, according to Glynn Bennion, was for a herder to fill the rangeland “so heavily that at no time of the year would there be feed enough growing on it to tempt some rival stockmen to crowd in on him.”<sup>84</sup> Another strategy, which likely put less pressure on grazing resources than overstocking, was to collectivize sheep herding operations. During the 1890s, many independent grazers formed cooperatives whose combined assets allowed them to acquire property rights to valuable grazing lands.

Likely the most successful of these enterprises was run by a group of Mormon sheep operators from Wood Cross, Utah, who had combined their interests to form the Deseret Live Stock Company (DLC).<sup>85</sup> When it was established in 1890, the DLC had 28,830 sheep but no private land holdings.<sup>86</sup> Within six months of its formation, the DLC declared a 10 percent cash dividend to its stockholders. As profits continued to climb, the company enlarged its herd to more than 50,000. They also began to buy all the ranching land they could profitably use.<sup>87</sup> The company purchased private lands, state lands, railroad property, and it paid individuals to homestead land with water resources.<sup>88</sup> The largest purchases came during World War I. Favorable wartime markets for wool and mutton allowed the DLC to purchase several large ranches in the Monte Cristo Mountains, near the Wyoming-Utah border. These were used for summer range and a 20,000 acre ranch in Skull Valley was acquired for winter use. Together they gave the

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<sup>84</sup> Bennion, “Lets Stop Kidding Ourselves,” 5. For further details on stocking patterns, see Charles S. Peterson, “Grazing in Utah,” 314.

<sup>85</sup> Moss, “The Deseret Live Stock Company,” 8-17; McMurrin, *The Deseret Live Stock Company*, 1-3.

<sup>86</sup> McMurrin, *The Deseret Live Stock Company*, 2.

<sup>87</sup> Moss, “The Deseret Live Stock Company,” 18.

<sup>88</sup> Moss, “The Deseret Live Stock Company,” 17-21; McMurrin, *The Deseret Live Stock Company*, 9.

company control of approximately 240,000 acres of strategic oases.<sup>89</sup> Each unit was acquired to provide “the necessary feed and water for a particular season—spring, summer, fall, or winter—for a particular number of cattle and sheep.” The DLC thus created an integrated super ranch that looked “like a jig saw puzzle picture” yet “each piece [functioned] like a link in a chain.”<sup>90</sup>

These ranching lands allowed the company to consistently maintain between 40,000 and 60,000 sheep until the 1930s and while there were a number of years in which the DLC struggled, business steadily expanded during this forty-year period.<sup>91</sup> In its first ten years, the company’s total capital stock increased from \$90,000 in its founding year to \$150,000.00 in 1899, an increase of nearly 67 percent. By 1925, the company’s total capital stock was valued at \$750,000.<sup>92</sup> Most of the profits came directly from sheep and wool production, but the DLC also ran a small mercantile store.

The company’s earnings benefited many people and interests across the Bonneville Basin. To manage such large annual livestock operations, the DLC employed nearly a hundred individuals.<sup>93</sup> The company developed a reputation for being considerate to its nearly 250 community-based stockholders, giving generous cash

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<sup>89</sup> Everett L. Cooley and Margery W. Ward, “Register of the Records of the Deseret Live Stock Company Records, 1891-1976, Ms 105, Box 3, Folder 11, Western Americana, J. Willard Marriott Library, University of Utah, Salt Lake City (hereafter cited as Deseret Live Stock Company Records); McMurrin, *The Deseret Live Stock Company*, 8; Moss, “The Deseret Live Stock Company,” 17-25; McMurrin, *The Deseret Live Stock Company*, 7-10.

<sup>90</sup> “Deseret Livestock Company v. The U.S. Government,” Deseret Live Stock Company Records, Box 4, Folder 8.

<sup>91</sup> Moss, “The Deseret Live Stock Company,” 3-4; McMurrin, *The Deseret Live Stock Company*, 7-8. The company suffered from the same slumps that many livestock operators faced. The Panic of 1893 caused the burgeoning company to lose profits for a year. Also, from 1900 to 1907 the intermountain region was struck with a blight of scabies, which peaked in 1903, that devastated livestock. Figures show that of the 1,984,454 sheep inspected by the state over 1,214,959 had been infected with scabies. In these years the company’s profits were marginal. Finally in 1920-1921 there was a recession partly caused by the market collapse for wool and mutton after the end of World War I in 1918. For further details, see Moss, “The Deseret Live Stock Company,” 82-96; McMurrin, *The Deseret Live Stock Company*, 4, 7, 8, 10.

<sup>92</sup> James R. Moss provides a detailed overview and assessment of the Deseret Live Stock Company’s fiscal figures from 1890 to 1934, see Moss, “The Deseret Live Stock Company,” 82-97. Also, see Jean Ann McMurrin, *The Deseret Live Stock Company*, 2, 10-11.

<sup>93</sup> Moss, “The Deseret Live Stock Company,” 49-50.

dividends that at times averaged around 25 percent of investments.<sup>94</sup> Since company directors were Mormons, they also tithed another 10 percent of their annual earnings to the LDS Church.<sup>95</sup> Moreover, the DLC owned so much land that they had to pay substantial federal, state, and county taxes.<sup>96</sup>

The DLC became one of the most successful sheepherding operations in the Bonneville Basin. By collectivizing their interests, the directors of DLC gained control of crucial environmental resources which allowed them to expand and out-compete rival operations. Undoubtedly their success forced some smaller sheep operations out of business. At the same time, their operations benefited many people across the Bonneville Basin. Their success, though, was a small part of a much larger industry that shaped the social and environmental history of the Bonneville Basin. The industriousness of individual sheepherders such as Nicholes and companies like the DLC helped the industry prosper and have a wide-ranging impact, yet while sheep owners adapted to each other in competitive struggles over rangelands by adopting different strategies to internally regulate the industry, they were unable to adapt to the land.

#### **The Environmental Consequences of Unsustainable Grazing Practices**

James Young's study *Cattle in the Cold Desert* offers the most sophisticated account about the Great Basin's livestock industry and its ecological impact on the local sagebrush and grassland plant communities. In many respects, what happened in the West Desert from the 1850s to the 1930s paralleled what Young calls the "exploitation pageant" of cattle ranching in north, central Nevada. Young notes that "the nineteenth-

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<sup>94</sup> While there was variation in the amount given and in certain troublesome years like 1893 no dividends were given, James R. Moss notes how during stable years the average was around 25%. For further details, see Moss, "The Deseret Live Stock Company," 83-84, 88, 97; Walter Dansie to Harlan B. Watkins, 1 July 1952, Deseret Live Stock Company Records, Box 5, Folder 6.

<sup>95</sup> McMurrin, *The Deseret Live Stock Company*, 4.

century method of determining stocking rates for the new rangelands of the West was to increase stock until losses became unacceptable.”<sup>97</sup> Under this logic, the rangelands of the central Great Basin, like parts of the West Desert, were stocked with thousands of livestock by the early 1870s. The consequences, as Young observed, were the shattering of native ecologies.<sup>98</sup> Most pre-contact forage in the Great Basin “lacked the resilience, depth, and plasticity to cope with concentrations of large herbivores.” They quickly succumbed to grazing pressure, and were replaced by less desirable forage such as juniper and pinyon pine and exotic invaders like Russian thistle and cheatgrass.<sup>99</sup>

The consequences of heavy grazing in the West Desert were equally drastic.

Sydney Nicholes observed how

by about 1910 the range [in the West Desert] became very crowded and overstocked and deterioration had begun in quantity and quality of forage. After the grass had largely disappeared, the stock subsisted more and more on sagebrush and other brush species. All the sages, shadscale and brush were thinned out and partly killed. Supplemental feeding of corn and cottonseed cake became necessary about 1917 and is now the general rule with most outfits.<sup>100</sup>

As the quality of forage declined from grazing pressure, more and more sheepherders had to rely on supplemental feed to sustain flocks through the winter, yet perversely, the shift to supplemental feed became “only another device by which the poor, wretched remnants of forage plants left there [were] grubbed still closer to utter extinction.”<sup>101</sup> This new regime likely allowed herders to maintain large herds on the range until the 1930s. Then a

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<sup>96</sup> Walter Dansie to Harlan B. Watkins, 1 July 1952.

<sup>97</sup> James Young, *Cattle in the Cold Desert*, 254.

<sup>98</sup> James Young, *Cattle in the Cold Desert*, xiv.

<sup>99</sup> James Young, *Cattle in the Cold Desert*, xiv.

<sup>100</sup> “Statement of Sidney Nicholes Concerning the Depletion of Range on the West Desert of Utah, and the Economic Effects on the Livestock Industry,” *Works Progress Administration (Utah Section) “History of Grazing” Notes, 1940-1941*, Mss B 100, Box 3, Folder 9, Utah State Historical Society, Salt Lake City.

<sup>101</sup> Bennion, “Lets Stop Kidding Ourselves,” 4.

severe drought finally deteriorated the region's forage to the point that the West Desert could no longer support the livestock industry.

In the mid 1930s, for example, Glynn Bennion noted how "the west desert today is a place of the most awful desolation imaginable. No feed anywhere.... great white sage fields have been gone for years; the curly sage, what there is left of it, is grubbed to unrecognizable stubs. You must search a heartbreakingly long time to find one bunch of grass."<sup>102</sup> A 1940 study on the forage of the West Desert similarly noted "heavy injury to the plant cover, resulting in reduced forage production and a serious replacement of the most valuable forage species by plants largely unpalatable to livestock."<sup>103</sup> Another study estimated that on the "heavily grazed sections of the west desert, between two and six inches of soil had blown away by 1935."<sup>104</sup>

The deterioration, not only hurt livestock operators but local inhabitants as well. This was most evident in the town of Grantville, twenty miles west of Tooele, where dust became a serious health threat. An April 1933 report by the Soil Conservation Service noted a series of dust storms in the area, the worst of which occurred in December 1934

This lasted two or three days and caused living conditions in Grantsville and vicinity to become almost unbearable and travel on the highways very hazardous and at times to be suspended altogether. Similar storms occur every few days the year around. In fact, dust is rising from the area at some point or other all the time except during periods of extreme moisture conditions.<sup>105</sup>

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<sup>102</sup> Bennion, "Let's Stop Kidding Ourselves," 3-4.

<sup>103</sup> George Stewart, Walter P. Cottam, and Selar S. Hutchings, "Influence of Unrestricted Grazing on Northern Salt Desert Plants Associations in Western Utah" *Journal of Agricultural Research* 60 (March 1940): 289.

<sup>104</sup> Brian Q. Cannon, "Struggle against Great Odds: Challenges in Utah's Marginal Agricultural Areas, 1925-39," *Utah Historical Quarterly* 54 (Fall 1986): 312.

The removal of ground cover from decades of grazing led to ever worsening storms.

Local officials noted in 1936 that

the worst dust storm these people have encountered continued over a period of eighteen hours unabated. The inhabitants here were unable to breathe and they were in complete panic, some running to cellars in order to get out of the dust, while others were compelled to wear wet towels over their faces to keep from smothering.<sup>106</sup>

Livestock also suffered terribly, and a number of animals simply choked to death on the dust.<sup>107</sup>

Propelled by recent shifts at the federal level toward the use of public lands, an extensive study by leading range scientists in Utah concluded the drought was not the “the sole or even the chief cause of present deterioration and depletion of the range [in the West Desert]. Instead, it points unmistakably to unrestricted grazing as the chief cause of loss of grazing values, invasion of inferior species, and the gradual crowding out of the most palatable range plants.”<sup>108</sup> There is much evidence to support this conclusion.<sup>109</sup> From 1897 to 1904, for example, the West Desert suffered from an even more severe drought, yet there was no marked deterioration of rangeland forage.<sup>110</sup> The most severely injured plant communities in the 1930s, moreover, were primarily those palatable to livestock.<sup>111</sup>

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<sup>105</sup> “Grantsville Dust Storm,” *Works Progress Administration (Utah Section) “History of Grazing” Notes, 1940-1941*, Mss B 100, box 4, folder 20, Utah State Historical Society, Salt Lake City, 2; “Excerpt from WPA Report,” in *History of Tooele County*. ed. Orrin P. Miller, Vol. II (Tooele: Tooele Transcript Bulletin, 1990), 160-161.

<sup>106</sup> “Grantsville Dust Storm,” 3; “Excerpt from WPA Report,” 160-161.

<sup>107</sup> “Grantsville Dust Storm,” 3; “Excerpt from WPA Report,” 160-161.

<sup>108</sup> Stewart, “Influence of Unrestricted Grazing,” 314.

<sup>109</sup> A number of studies suggest the rangeland deterioration in the West Desert was primarily due to grazing pressure, see Stewart, “Influence of Unrestricted Grazing”; Cottam, “Is Utah Sahara Bound?”; Walter P. Cottam, “The Impact of Man on the Flora of the Bonneville Basin,” (paper presented at the University of Utah, Salt Lake City, 20 February 1961), Pam 4758, Utah State Historical Society, Salt Lake City; Charles W. Menzies, “Effects of Overgrazing on the Mortality of Desert Browse on the Utah West Desert” (MA Thesis, Brigham Young University, 1935); Garry F. Rogers, *Then & Now: A Photographic History of Vegetation Change in the Central Great Basin Desert* (Salt Lake City: University of Utah Press, 1982).

<sup>110</sup> Stewart, “Influence of Unrestricted Grazing,” 314.

<sup>111</sup> Stewart, “Influence of Unrestricted Grazing,” 313.

## Conclusion

While livestock operators may have been one of the few groups of Euroamericans not to have initially seen the West Desert as a marginal landscape, they played a primary role in turning it into one. From the 1850s onward, grazers imposed a new regime on the West Desert that was strikingly different from early inhabitants' sophisticated land-use patterns. They grazed millions of sheep on the "splendid feed" that was considered "without limit in every direction."<sup>112</sup> This new environmental regime became the prevalent pattern of land use in the West Desert for nearly sixty years. Largely because sheepherders found value in lands that others deemed worthless, they had free rein to utilize resources with little outside oversight. This made it easier for herders to adopt heavy land use practices that made severe environmental impacts. The early deterioration of the sagebrush grasslands in the Tooele and Rush Valleys demonstrated the finite nature of local forage. Grazers adjusted to the diminishing resources by out-competing rival operators. They moved to untouched ranges, stocked ranges to their full capacity, or acquired exclusive rights to grazing lands. Even with these measures forage continued to deteriorate. Supplemental feeding helped to maintain high sheep numbers on the range, but the long-term effects of heavy grazing, coupled with a severe drought, apparently pushed plant communities past a critical threshold.<sup>113</sup> By the mid 1930s, the West Desert could no longer support the livestock industry and had become a hazardous place to live. Even sheepherders viewed the West Desert as a marginal landscape. Glynn Bennion, for example, pointed out how the "pioneer made the desert blossom as the rose—inside his irrigated field. Outside the fence he and his children have made it ten times more a desert than it was before."<sup>114</sup>

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<sup>112</sup> Bennion, "Lets Stop Kidding Ourselves," 4; Stewart, "Agriculture and Grazing Ecology in Utah," 370.

<sup>113</sup> For a discussion on the broader causes and consequences of overgrazing in Western North America, see Donald Worster, "Cowboy Ecology," in *Under Western Skies* (New York: Oxford University Press, 1992), 34-52.

<sup>114</sup> Bennion, "Lets Stop Kidding Ourselves," 5.

Rangeland deterioration was only one of many factors that damaged the sheep industry in the 1930s. The precipitous collapse of markets for wool and sheep that followed the stock market crash of 1929 “tipped over” the sheep industry in the Bonneville Basin.<sup>115</sup> The DLC was able to secure large loans from the federal government to help survive the Great Depression, but many other livestock operations were not so fortunate. During the decade “tens of thousands of Utah farmers and stock owners defaulted on taxes, interest, and other debts.”<sup>116</sup> As a result, banks and other service industries that supported livestock operations also went bankrupt.<sup>117</sup>

The dire environmental conditions, along with the severe economic situation, eventually attracted federal intervention. In 1934 the Federal Surplus Relief Corporation paid out \$112 million to remove animals from the range, assure stock owners a reasonable market for their animals, and channel meat to families in need.<sup>118</sup> Of more long-term significance, Franklin D. Roosevelt, in a move anticipating the Taylor Grazing Act, withdrew 2.4 million acres of winter grazing land in the West Desert in February of 1934. After the passage of the Taylor Grazing Act that June much of the West Desert became Utah Grazing District #2.<sup>119</sup>

The Taylor Grazing Act, itself a consequence of widespread failure of grazing and homesteading throughout the arid west, placed many restrictions on herders’ transhumance operations. The goal was to promote more ecologically and economically sustainable grazing practices, but the impact of these restrictions varied. The DLC initially felt that the Act was “made to order” because, as the company’s manager remarked, “we had more private lands per animal grazed on the public domain than any

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<sup>115</sup> For quote, see Nicholes, 48. For details on the collapse of wool and sheep markets, see Cooley, “Register of the Records of the Deseret Live Stock Company,” 4; McMurrin, *The Deseret Live Stock Company*, 11.

<sup>116</sup> Peterson, “Grazing in Utah,” 318.

<sup>117</sup> For an account on shepherders and banks going bankrupt, see Chipman, 12.

<sup>118</sup> Leonard J. Arrington, “Utah’s Great Drought of 1934,” *Utah Historical Quarterly* 54 (Summer 1986): 245-264.

<sup>119</sup> Bluth “Confrontation with an Arid Land,” 159-163.

other outfit in the west so far as I know, and our continuous use of the Federal range dates back to 1891 and before.”<sup>120</sup> Because of their extensive landholding and longstanding documented usage, the DLC eventually acquired permits to 268,920 acres of winter grazing land, the largest allotment given to any sheep operation in the West Desert.<sup>121</sup> The Grazing Bureau had a harder time satisfying small, independent operators. Nicholes, for example, noted that “when the BLM came in... it just wiped those small outfits out everywhere.”<sup>122</sup> The few that survived had to deal with new regulations and fees that effectively put an end to the unrestricted style of ranching long practiced by sheepherders.<sup>123</sup> At the same time, many grazers recognized the need for regulation. Even critics such as Nicholes grudgingly admitted that “it might have been a good thing in the end.”<sup>124</sup>

Developments in the 1930s effectively marginalized the once thriving sheep industry of the Bonneville Basin. In 1930, 56 percent of all agricultural revenue came from the livestock industry, but by 1945 the industry accounted for only 18 percent of total agricultural income and only 4 per cent of total income in Utah.<sup>125</sup> Still the DLC and many independent sheepherders continued to sustain their operations by running sheep in the West Desert. After 1940 these operators faced new challenges as the U.S. military imposed a new environmental regime that had long-lasting consequences.

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<sup>120</sup> Walter Dansie to Mr. C.F. Moore, 19 August 1952, Deseret Live Stock Company Records, Box 4, Folder 6.

<sup>121</sup> Deseret Livestock Company v. The U.S. Government,” 2.

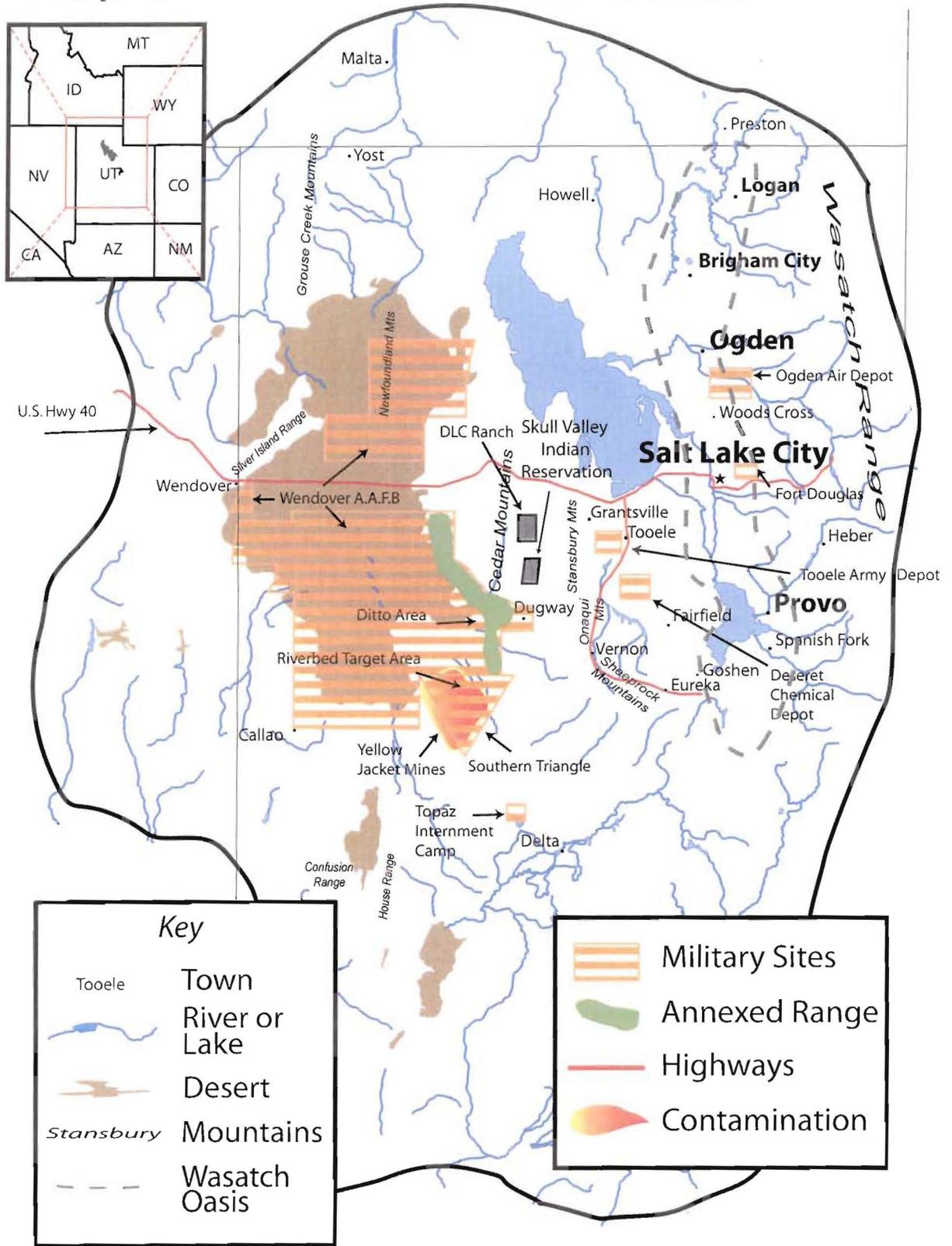
<sup>122</sup> Nicholes, 5.

<sup>123</sup> For further details on how these new regulations affected sheepherders, see Nicholes, 5, 65, 66, 74, 80.

<sup>124</sup> Nicholes, 12, 118.

<sup>125</sup> By this time the defense industry had come to dominant the regional economy. For statistics on sheep, see Charles S. Peterson, “‘Touch of the Mountain Sod’: How Land United and Divided Utahns 1847-1985,” (Paper presented at the Dello G. Drayton Memorial Lecture, Weber State College, Ogden, Utah, 1988), Pam 20551, Utah State Historical Society, Salt Lake City, Utah, 12; J.R. Mahoney, *Utah Economic and Business Review 5* (Salt Lake City: University of Utah, 1946) quoted in Cottam, “Is Utah Sahara Bound?,” 11.

# Map 3: Wartime in the West Desert



**CHAPTER II**  
**FROM PASTORAL TO NATIONAL SECURITY:  
WARTIME IN THE WEST DESERT**

**Introduction**

In the early 1940s, the West Desert was rapidly transformed from a pastoral retreat into a rehearsal stage for war. The region's isolation and abundance of federal lands, which were perfect for grazing, were also its undoing. These same characteristics made the West Desert ideal for testing and storing some of the most lethal weapons and toxic substances ever devised. The need to maintain national security was the driving force behind military development, but it came at a cost. During World War II, weapons testing contaminated thousands of acres of land with hazardous materials. Large areas of the West Desert became "no man's lands" that were particularly hazardous to those people and animals that had previously depended on the land. And although military development provided critical economic opportunities to many residents in the Bonneville Basin, its environmental impact, which set aside millions of acres of land for the military's exclusive use, undermined the most prominent, longstanding, and prosperous industry in the West Desert.

To understand the nature of the military's social and environmental impact we need to remember why the defense industry was attracted to the Bonneville Basin, what kind of military installations were established, and how these developments shaped the local economy. Investigating who benefited and who suffered when the dominant modes of production changed, while detailing the broader social and environmental effects of military development, provides insight not only into the impact of the defense industry on

the West Desert but also into the relationship between war, the environment, and human history.<sup>1</sup>

### **World War II Military Development in the Bonneville Basin**

Historian Gerald Nash has detailed how open space, favorable climates, aggressive local boosters, and underdevelopment “provided an inviting milieu for technological innovation and experimentation” in the western U.S. during and after World War II.<sup>2</sup> These factors were critical in attracting defense industries to the Bonneville Basin, but distinctive social and geographic factors were also important. Rapid population growth and high unemployment hurt Bonneville Basin residents during the Great Depression. With war looming, however, these became assets to military industries.<sup>3</sup> During the Depression, moreover, residents had become increasingly dependent on federal spending and, as with Camp Floyd in the nineteenth century, readily embraced additional expenditures from the defense industry in the 1940s.<sup>4</sup> Geographically, the basin also offered a number of advantages, including its equidistant position from the primary West Coast ports in Seattle, San Francisco, and Los Angeles.

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<sup>1</sup> For further discussions on viewing environmental change as a product of competing environmental agendas, see Hurley, *Environmental Inequalities*, xiv, 1-14, 180-183; Douglas R. Weiner, “A Death-defying Attempt to Articulate a Coherent Definition of Environmental History,” *Environmental History* 10 (July 2005): 404-420; William Cronon, “Modes of Prophecy and Production: Placing Nature in History,” *The Journal of American History* 76 (March 1990), 1131; Carolyn Merchant, “Ecology and History,” in *Ecological Revolutions, Nature, Gender, and Science in New England* (Chapel Hill: The University of North Carolina Press, 1989), 2-3, 22-23. For discussions on the importance war to the field of environmental history, see Tucker, *Natural Enemy*, 1-15; Russell, *War and Nature*, 1-16.

<sup>2</sup> Gerald Nash, *Federal Landscape: An Economic History of the Twentieth-Century West* (Tucson: University of Arizona Press, 1999), 79.

<sup>3</sup> For further information on the impact of the Great Depression in the Bonneville Basin, see Leonard Arrington, “The Sagebrush Resurrection: New Deal Expenditures in the Western States, 1933-1939,” *Pacific Historical Review* 52 (February 1983), 1-16; John McCormick, “The Great Depression,” *Utah History Encyclopedia*, <http://www.media.utah.edu/UHE/d/DEPRESSION,GREAT.html>; John F. Bluth and Wayne K. Hinton, “The Great Depression,” in *Utah's History*, eds., Richard D. Poll et al. (Logan: Utah State University Press, 1989): 481-496; Russell R. Elliot, *History of Nevada* (Lincoln: University of Nebraska Press, 1973), 273-306; Antonette Chambers Noble, “Utah’s Defense Industries and Workers in World War II,” *Utah Historical Quarterly* 59 (Fall 1991): 365-367.

<sup>4</sup> Total expenditures of all New Deal agencies in the intermountain region was \$716.3 per capita which was well above the national average of \$399 and also above other regions in the west, with \$536 being spent in the Pacific Coast states, \$424 in the Great Plains states, and \$380 in the Midwest. For further details, see Arrington, “The Sagebrush Resurrection,” 5-8, 11-12.

The region's interior location was considered beneficial because of fears that the Pacific Coast was vulnerable after the attack on Pearl Harbor. Finally, the Bonneville Basin contained an abundance of federal lands that the U.S. Military could annex without much difficulty.

These social and geographic factors made the Bonneville Basin highly attractive to the defense industry. According to historians Thomas Alexander and Leonard Arrington, during World War II the federal government spent between \$600 and \$650 million on military facilities, and more than \$240 million on privately operated defense plants like Geneva Steel Works in Provo and Remington Arms Ordnance in Ogden.<sup>5</sup>

This development reshaped the region's economy. By 1945, five large military maintenance and supply depots for the Army and Navy were established or expanded in the Bonneville Basin.<sup>6</sup> The depots became industrial forces. The Ogden Air Depot (now Hill Air Force base) employed 15,780 civilians and 6,000 military personal by 1943, making it the largest employer in the Bonneville Basin.<sup>7</sup> Defense spending also helped to turn the Bonneville Basin into the "military nerve center" of the American West.<sup>8</sup> Fort Douglas (formerly Camp Douglas) was renovated and became the regional headquarters for the Ninth Service Command, which directed military operations in both the coastal

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<sup>5</sup> Thomas G. Alexander and Leonard J. Arrington, "Utah's Small Arms Ammunition Plant during World War II," *Pacific Historical Review* 34 (May 1966): 185.

<sup>6</sup> Leonard J. Arrington and Thomas G. Alexander, "Supply Hub of the West: Defense Depot Ogden, 1941-1964," *Utah Historical Quarterly* 32 (Spring 1964): 99-121; Leonard J. Arrington and Thomas G. Alexander, "They Kept 'Em Rolling: The Tooele Army Depot, 1942-1962," *Utah Historical Quarterly* 31 (Winter 1963): 7-25; Leonard J. Arrington and Archer J. Durham, "Anchors Aweigh in Utah: The Naval Supply Depot at Clearfield, 1942-1962," *Utah Historical Quarterly* 31 (Spring 1963): 109-126; Leonard J. Arrington, Thomas G. Alexander, and Eugene A. Erb, Jr., "Utah's Biggest Business: Ogden Air Material Area at Hill Air Force Base, 1938-1965," *Utah Historical Quarterly* 33 (Winter 1965): 9-33; John E. Christensen, "The Impact of World War II," in *Utah's History* eds. Richard D. Poll et al (Logan: Utah State University Press, 1989), 498-500.

<sup>7</sup> Arrington, "Utah's Biggest Business," 13-14; Thomas G. Alexander, "Ogden, A Federal Colony," *Utah Historical Quarterly* 47 (Summer 1979): 294-295. This base is still the state's largest employer. For details, see "Hill Air Force Base History," *Hill Air Force Base*, <http://www.hill.af.mil/main/library/history/index.html> (accessed 21 May 2007).

<sup>8</sup> Arrington, "The U.S. Army Overlooks Salt Lake Valley," 344.

and intermountain states. Fort Douglas also served as an induction center for military recruits and its finance office oversaw all operations in the Bonneville Basin.<sup>9</sup>

The military installations in the Wasatch Oasis were regionally significant, but the largest installations, in terms of land consumed, were located in the West Desert. The defense industry valued the West Desert's equidistant location, but they also favored its possibilities for security. The region's relative isolation, for example, made it suitable for imprisoning approximately 8,000 Japanese Americans, most of whom were U.S. citizens. From 1942 to 1945 this population was held captive behind barbed wire fences at what became known as Topaz Internment Camp located northwest of Delta, Utah.<sup>10</sup> The United States Army Air Forces (USAAF), on the other hand, found the West Desert's wide expanse of flat land ideal for a bombing range. The government established a base in Wendover on the border between Utah and Nevada, and the bombing range was located in the adjacent lowland playas. At its height, this range covered 1,822,000 acres of land.<sup>11</sup> The USAAF used it for a variety of training exercises for B-17, B-24 and B-29 bombers during WWII. Most notably, the crews of the 509<sup>th</sup> Bombardment Squadron practiced bombing runs in preparation for the atomic bombing of Hiroshima and Nagasaki in August 1945.<sup>12</sup>

Southwest of Tooele, the Army also established the Tooele Army Depot (TAD). This 44,000 acre installation, holding vast storage capacities and several large vehicle and artillery repair shops, received \$52 million in facilities investments and employed

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<sup>9</sup> Arrington, "The U.S. Army Overlooks Salt Lake Valley," 344-346.

<sup>10</sup> Yoshiko Uchida, "Topaz, City of Dust" *Utah Historical Quarterly* 48 (Summer 1980): 234-237, 243.

<sup>11</sup> Roger D. Launius, "Home on the Range: The U.S. Air Force Range in Utah, a Unique Military Resource," *Utah Historical Quarterly* 59 (Fall 1991): 334.

<sup>12</sup> Launius, "Home on the Range," 331-345; Leonard J. Arrington and Thomas Alexander, "World's Largest Military Reserve: Wendover Air Force Base, 1941-63," *Utah Historical Quarterly* 59 (Fall 1963): 327-332.

between 1,400 and 2,000 civilians during the war.<sup>13</sup> The depot became the main engine of the Tooele County's economy until the end of the Cold War, contributing hundreds of millions of dollars in payroll and other related expenditures.<sup>14</sup>

The most stable and versatile military installation was Dugway Proving Ground (DPG). In 1941, the Army's Chemical Warfare Service (CWS) needed a large-scale chemical weapons (CW) testing area. In January 1942, Colonel John R. Burns surveyed the West Desert northwest of Lookout Pass. Burns saw in the desert an advantageous climate and the necessary open space for large-scale testing of chemical weapons. The CWS initially acquired 268,400 acres of land.<sup>15</sup> Burns told local military construction crews to build facilities "anywhere on the desert."<sup>16</sup> Contractors found a suitable site on some sand dunes northwest of Camel's Back Ridge near Government Creek Basin, the same area where Nicholes and other herders had picketed their herds in the late fall while waiting for the snow to arrive.<sup>17</sup> Today known as the Ditto Area, the new installation opened in summer 1942 conducting large-scale weapons testing operations on grids near Granite Peak.<sup>18</sup> The Army also constructed a chemical weapons storage depot in northern

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<sup>13</sup> Arrington, "They Kept 'Em Rolling," 1-25; Gerald Nash, *World War II and the West: Reshaping the Economy* (Lincoln: University of Nebraska Press, 1990), 5.

<sup>14</sup> Blanthorn, *A History of Tooele County*, 247-54; Arrington, "They Kept 'Em Rolling," 3-4, 12, 19.

<sup>15</sup> U.S. Army Test & Evaluation Command, "Dugway Proving Ground, Dugway, Utah," *Orientation Folder* (Dugway, UT: U.S. Army Test & Evaluation Command, 1964), Pam 8294, Utah State Historical Research Society, Salt Lake City; Leonard J. Arrington and Thomas G. Alexander, "Sentinels on the Desert: The Dugway Proving Ground (1942-1963) and Deseret Chemical Depot (1942-1955)" *Utah Historic Quarterly* 32 (Fall 1963): 32-36; Parsons Engineering Science Inc., "Dugway Proving Ground, Dugway Utah Final Phase 1 RCRA Facility Investigation Report," (Dugway, UT: Parsons Engineering Science Inc., 1999), 2-1.

<sup>16</sup> Elmer G. Thomas, "Autobiography," MSS A 2245, Utah State Historical Research Society, Salt Lake City, 49.

<sup>17</sup> In addition to transitory sheepherders, a family-based livestock and farming operation was based at Government Creek in the early 1900s. For further details, see Nicholes, 80-82, Chipman, 21-25.

<sup>18</sup> Arrington, "Sentinels on the Desert," 34-37.

Rush Valley called Deseret Chemical Depot.<sup>19</sup> This facility encompassed 19,364 acres of land and eventually held 44.5 percent of the U.S.'s stockpile of chemical weapons.<sup>20</sup>

As with the establishment of Camp Floyd eighty years earlier, the residents of the Bonneville Basin benefited greatly from wartime spending and development.<sup>21</sup> National security was big business, and the defense industry became an integral component of the local economy. By 1942 war industries employed nearly 49,500 people and the military had stationed an additional 50,000 personnel in the basin.<sup>22</sup> By 1943, the unemployment rate had dropped to nearly 1 percent.<sup>23</sup> By 1945, 27.7 percent of all personal income in Utah came directly from government employment. Most of these jobs were in the defense industry.<sup>24</sup> This dominance declined in the postwar years, but the defense industry continued to employ more Bonneville Basin residents than any other industry until the late 1960s, and Tooele County was the most dependent on the industry.<sup>25</sup> From the 1940s until the end of the Cold War, roughly half the county found employment at TAD, DCD, or DPG.<sup>26</sup>

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<sup>19</sup> The use of "Deseret" in the name was likely a PR strategy adopted to help alleviate local concerns over the potentially dangerous materials that would be stored there.

<sup>20</sup> Arrington, "Sentinels on the Desert," 37-38; Global Security, "Deseret Chemical Depot, Tooele, Utah," <http://www.globalsecurity.org/wmd/facility/deseret.htm>; Blanthorn, *A History of Tooele County*, 251-252; Nash, *World War II and the West*, 5.

<sup>21</sup> A number of scholars have investigated the economic impact of WWII on the Bonneville Basin, see James L. Clayton, "An Unhallowed Gathering: The Impact of Defense Spending on Utah's Population Growth, 1940-1964," *Utah Historical Quarterly* 34 (Summer 1966): 227-242; Alexander, "Utah's War Industry during World War II," 72-92; Mahoney, "Wartime Economic Changes," 5-19; Noble, "Utah's Defense Industries," 365-379; Christensen, "The Impact of World War II," 498-500.

<sup>22</sup> Clayton, "An Unhallowed Gathering," 230; Christensen, "The Impact of World War II," 505.

<sup>23</sup> Alexander, "Utah's War Industry during World War II," 82.

<sup>24</sup> Alexander, "Utah's War Industry during World War II," 74.

<sup>25</sup> Arrington, "They Kept 'Em Rolling," 3-4; Christensen, "The Impact of World War II," 498-500, 504-505; James L. Clayton, "Contemporary Economic Development," in *Utah's History* eds. Richard D. Poll et al (Logan: Utah State University Press, 1989), 534-536, 542; Ross F. Peterson, "Utah Politics Since 1945," in *Utah's History* eds. Richard D. Poll et al (Logan: Utah State University Press, 1989), 526-527; Thomas G. Alexander, "The Cold War, Korean War, & The Resurrection of Utah's Defense Establishment," *Utah History to Go*, [http://historytogo.utah.gov/utah\\_chapters/utah\\_today/coldwar/koreanwarandutahdefenseestablishment.html](http://historytogo.utah.gov/utah_chapters/utah_today/coldwar/koreanwarandutahdefenseestablishment.html) (accessed 21 May 2007).

<sup>26</sup> J. Wayne McArthur and Harry Woodward, *An Economic Profile of Tooele County: With Employment Projections to 1975, 1980, and 1990* (Salt Lake City, Mountain Area Planners, 1970), vii; F. Hardy Cherry and Marlan James Coe, *Tooele/Box Elder County Demographic Maps, Volume 1*, (Highland, UT, Geosoft, 1993), 10; Alexander, "Utah's

## **The Environmental Impact of Weapons Testing during World War II**

The sheep boom severely altered the environment of the West Desert, but the changes wrought by defense industries during World War II had an even more dramatic impact. All West Desert defense installations altered the land, but the land-use patterns at Dugway Proving Ground embodied elements of activities conducted all across the West Desert. In addition to performing large-scale chemical, biological, and, later, radiological weapons tests, for example, Dugway also eventually stored ten thousand pounds of chemical weapons and commonly dropped conventional bombs and munitions on its testing grids. The nature of these varied activities at DPG, which was also the most longstanding of the West Desert installations, suggests how military development and activity affected vast stretches of the desert.

Weapons testing was the most dominant and widespread activity performed by the military during WWII. According to official military accounts, WWII testing at Dugway developed new weapon capabilities and technologies that contributed to Allied military success in both the Pacific and European theaters of wars, but this success had its costs. The earliest tests at Dugway focused on newly-developed incendiary devices such as napalm bombs and flamethrowers. To evaluate these weapons' effectiveness on real German and Japanese cities, the military designed a full-sized village consisting of twenty-four Japanese and six German buildings. These buildings were meticulously designed by leading architects and constructed from bona fide building materials flown in from as far

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War Industry during World War II," 75; Arrington, "They Kept 'Em Rolling," 12, 19; Clayton, "An Unhallowed Gathering," 232; Arrington, "Sentinels on the Desert," 37, 42; Dugway Proving Ground, "Final Environmental Impact Statement for Activities Associated with Future Programs at U.S. Army Dugway Proving Ground," (Dugway, Utah: Dugway Proving Ground, 2004), 3-153 to 3-155; Carolyn Palmer, "2 Tooele Bases 40 and Thriving," *Deseret News*, 27 July 1982, Dugway Newspaper Clippings, Western Americana, J. Willard Marriot Library, University of Utah, Salt Lake City (hereafter cited as Dugway Newspaper Clippings).

away as the Pacific Islands. According to one observer, the buildings were “as truly authentic as possible, down to the last detail. They were typical insofar as the curtains, children’s toys, and clothing hanging in the closets.”<sup>27</sup> The simulated village was then destroyed using a variety of incendiary bombing devices, which were later “employed with spectacular success by the Air Force against enemy production centers.”<sup>28</sup>

Although chemical agents were never employed on the battlefield during WWII, they were readily dispensed across the West Desert.<sup>29</sup> The most frequently tested agents included choking agent phosgene (CG), blood agents hydrogen cyanide (AC) and cyanogens chloride (CK), and the blistering agents mustard (H) and distilled mustard hydrogen cyanide (HD).<sup>30</sup> In addition to CW testing, a modest biological weapons testing program was based at DPG during the war. Colonel Burns noted how the biological division of the CWS “saw how good we were doing there [at Dugway] with chemical testing outdoors, and they wanted in too.”<sup>31</sup> In October of 1943, the Army reserved an isolated, 250-square mile tract near Granite Peak. Biological weapons tests at this site were limited during the war, but they foreshadowed a much more extensive program during the Cold War.<sup>32</sup>

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<sup>27</sup> Arrington, “Sentinels on the Desert,” 36; U.S. Army, “Dugway Proving Ground”; Blanthorn, *A History of Tooele County*, 264; For quote, see Russell, *War and Nature*, 105-106.

<sup>28</sup> After the simulated villages were destroyed they would rebuild them and conduct additional tests. For further details, see U.S. Army, “Dugway Proving Ground.” For a detailed account of this Dugway testing program and its impact on the European warfront, see Mike Davis, “Berlin’s Skelton in Utah’s Closet,” in *Dead Cities and Other Tales* (New York: New York Press, 2002), 33-64.

<sup>29</sup> The Geneva Protocol prohibiting the use of chemical weapons in warfare was adopted in 1925. Chemical weapons were never deliberately employed by the Allies or the Axis powers during World War II, despite the mutual accumulation of enormous stockpiles and the implementation of large field testing programs.

<sup>30</sup> Parsons Engineering Science Inc., “Dugway Proving Ground,” 2-1.

<sup>31</sup> Dale Van Atta, “Germ Agents Tested in Utah for 25 Years,” *Deseret News*, 21 February 1979, Dugway Newspaper Clippings.

<sup>32</sup> For details on the WWII BW testing program at Dugway, see Ed Regis, *The Biology of Doom: The History of America’s Secret Germ Warfare Project* (New York: Henry Holt and Company, 1999), 95-96; Van Atta, “Germ Agents Tested in Utah for 25 Years.”

In contrast, there were numerous CW tests at Dugway during the war. Likely the most extensive use of CW took place in summer 1944 under a test series called “Project Sphinx.” As with the test on the simulated village, Sphinx was directly related to strategic problems confronting allied forces. Allied soldiers had suffered terrible casualties from Japanese soldiers based in cave fortifications on Pacific Islands because conventional weapons could not penetrate the enemy’s subterranean fortifications.<sup>33</sup> To address this tactical problem, personnel at Dugway created what were described as “exact replicas” of the Japanese caves by digging tunnels and using existing mines and natural caves in mountain ranges both inside and outside the proving ground’s southern boundary. Various chemical warfare materials and high explosive devices were then employed against these simulated fortifications to gauge their effectiveness at reducing military resistance.<sup>34</sup>

Liberal amounts of chemical agents and other hazardous materials were used in these tests. On the Yellow Jacket Mines Area, located south of the proving ground’s borders in the Dugway Mountains, the Army spent more than 3,000 rounds of ammunition containing chemical warfare materials. They also dropped an estimated 12,000 pounds of conventional bombs, and dispersed twenty-three tons of chemical agents. Three other testing sites received similar amounts of warfare materials.<sup>35</sup> Of all

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<sup>33</sup> Montgomery Watson, “Draft, Formerly Used Defense Site, Engineering Evaluation/Cost Analysis Report, Yellow Jacket Ranges,” (Salt Lake City: Montgomery Watson, August 1996), 2-3 to 2-4; U.S. Army, “Dugway Proving Ground.” For a more detailed account of Project Sphinx, see John Ellis Van Courtland Moon, “Project SPHINX: The Question of the Use of Gas in the Planned Invasion of Japan,” *Journal of Strategic Studies* 12 (Summer 1989).

<sup>34</sup> U.S. Army, “Dugway Proving Ground”; Watson, “Yellow Jacket Ranges,” 2-3 to 2-4; Chemical warfare materials include chemical agents like mustard and incendiary devices like napalm bombs.

<sup>35</sup> M. Louise Cannon and Allen Robert Cannon vs. United States of America, (10th Cir., August 2003), <http://www.kscourts.org/CA10/cases/2003/08/02-4059.htm> (accessed 21 May 2007); Mountain States Legal Foundation, “Utah Family opposes Attempts to Kill Bombing Site Case,” 1 December 2006, [http://www.mountainstateslegal.org/press\\_releases.cfm?pressreleaseid=611](http://www.mountainstateslegal.org/press_releases.cfm?pressreleaseid=611) (accessed 21 May 2007). For further information on the amount of weapons tested during Project Sphinx, see U.S. Army, “A Memorandum Report on Attack Against Cave-type Fortifications,” (Dugway, UT: Dugway Proving Ground, 1945), [http://home.comcast.net/~joyce.knowlton/PDF/Proj\\_Sphinx.pdf](http://home.comcast.net/~joyce.knowlton/PDF/Proj_Sphinx.pdf) (accessed 21 May 2007); Watson, “Yellow Jacket

the chemical agents tested, mustard gas was considered the most effective and, according to official Army records, “hundreds of tons” of it were released during Project Sphinx.<sup>36</sup> Mustard was never employed in the Pacific, but the testing of flamethrowers and other incendiary devices during Project Sphinx were said to have “paid off heavily later in combat.”<sup>37</sup> Project Sphinx and earlier CW tests at DPG also assisted the development of the M-2 and M-4 mortars, considered to be the “pride of the chemical corps” because they “proved to be one of the most feared, respected, and versatile weapons of the war.”<sup>38</sup>

The strategic value of these programs were significant during the war, but there were also long-lasting ecological costs. Testing transformed areas of the West Desert into “no man’s lands” that were particularly harmful to those people who had relied on it for their living. During Project Sphinx, for example, the Army used active mineral mines on public land as targets. Jesse Fox Cannon held 89.5 mining claims on 1,425 acres of land in the Yellow Jacket Mines Area.<sup>39</sup> Cannon agreed to allow the Army to perform tests on his mines, but signed an agreement stating the Army would “leave the property of the owner in as good condition as it is on the date of the government's entry.”<sup>40</sup> Instead copious amounts of “toxic, smoke, and flame agents in bombs, mortar and artillery shells, rockets, and . . . light case tanks. Gasoline, butane, the non-persistent agents Phosgene,

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Ranges,” 2-1 to 2-23; Montgomery Watson, “Draft, Formerly Used Defense Site, UXO/CWM Investigation and Engineering Evaluation/Cost Analysis Report, Southern Triangle,” (Salt Lake City: Montgomery Watson, August 1996), 2-2 to 2-4, 2-11 to 2-22; Environmental Science and Engineering, Inc., “Update of the Initial Installation Assessment of Dugway Proving Ground, Utah,” (Dugway, UT: Environmental Science and Engineering, Inc., July 1988), 2-1, 2-3 to 2-4.

<sup>36</sup> U.S. Army, “*A Memorandum Report on Attack Against Cave-type Fortifications*,” ii; For quote, see Department of the Army, “Report of the Interagency Ad Hoc Committee for Review of Testing Safety at Dugway Proving Ground,” (Washington, D.C.: Department of the Army, 1968), PAM 21492, Utah State Historical Research Society, Salt Lake City, 12.

<sup>37</sup> U.S. Army, “Dugway Proving Ground.” Historian Edmund Russell has pointed out how such weapons killed far more people in the World War II than atomic bombs, see Russell, *War and Nature*, 3.

<sup>38</sup> U.S. Army, “Dugway Proving Ground.”

<sup>39</sup> Cannon v. United States of America.

<sup>40</sup> Lee Davidson, “Army Tests Ravaged Family’s Land: Military Blasted Mines Owned by Utahns with Tons of Chemical Agents,” *Deseret News*, 26 November 2004, <http://deseretnews.com/dn/view/0,1249,595107713,00.html> (accessed 24 May 2007); Cannon v. United States of America.

Hydrogen Cyanide, and Cyanogens Chloride, and the persistent agent Mustard Gas"

made the mines too hazardous to restore.<sup>41</sup> More than forty years later, the mines still had not been restored. A 1988 report on a survey of the site reported that

Discussion with long-time employees indicate that the surface UXOs [unexploded ordnance] and empty containers were cleared from the area but some subsurface UXOs could exist. . . . Due to an absence of records, DPG has not been able to better define the activities or exact locations where they occurred in the Yellow Jacket Area. The installation is to withdraw this area from. . . the Public Domain, and permanently add it to the current DPG land holdings because it is potentially contaminated from past Army activities.<sup>42</sup>

Nearly two decades later, the Army still has not gained title to the land. A 1996 study by the Army estimated that it would cost approximately \$12.3 million to remediate the site. Canon and his descendents only have received \$2,819.48 in compensation for the contamination of their property.<sup>43</sup>

Wartime projects also put sheep and shepherders at risk. One important area during Project Sphinx was the River Bed Target Area, located along the northern end of the Old River Bed near the proving ground's southwestern boundary. This was the same area that shepherders had relied on for spring runoff water during their easterly trek to summer ranges.<sup>44</sup> Nearly 5,000 rounds of rocket, mortar, bomb, and spray tank munitions containing mustard, phosgene, or cyanogens chloride were expended on the River Bed Target Area during Project Sphinx.<sup>45</sup> To the south, outside the proving ground's boundaries, lies another 42,960-acre range known as the Southern Triangle Joint Use Area. The Army never used the Southern Triangle Area as a target, but stray rounds from

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<sup>41</sup> Cannon v. United States of America.

<sup>42</sup> Environmental Science and Engineering, Inc., "Update of the Initial Installation Assessment," 2-4.

<sup>43</sup> Davidson, "Army Tests Ravaged Family's Land"; Cannon v. United States of America.

<sup>44</sup> Nicholes, 42-43, 68; Chipman, 35.

<sup>45</sup> Watson, "Southern Triangle," 2-2 to 2-3.

adjacent areas likely landed on the Southern Triangle Area.<sup>46</sup> Many sheepherders passed through this area in their semi-annual migrations.<sup>47</sup> A 1988 survey of the area reported that subsurface unexploded ordnance items containing both chemical and biological agents as well as high explosives likely still existed in this area.<sup>48</sup> The risk of someone accidentally encountering such devices was considered to be relatively low, but if a herder or his thousands of sheep had happened to encounter such ordnance, the result would have been catastrophic.<sup>49</sup>

Although sheepherders and miners suffered no notable incidents of direct, physical harm from exposure to hazardous contamination, the long-term harm to livestock and other rural industries remains less clear, and weapons testing also monopolized large tracts of land in such ways that effectively closed the West Desert to its pastoral past.

### **Environmental Dispossession: The Military Annexation of Grazing Lands**

During the first years of World War II, the U.S. Military took exclusive control of millions of acres of the Bonneville Basin. Along the Wasatch Oasis many farmers saw their properties appropriated.<sup>50</sup> Much larger tracts were annexed in the West Desert, barring local people and industries from resources. Some contemporary Goshutes, for example, claim that they were never consulted before the U.S. government placed numerous restricted military installations on what they described as “traditional Goshute territory.”<sup>51</sup> Out of all the interests that utilized resources in the West Desert, the

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<sup>46</sup> Watson, “Southern Triangle,” 2-2.

<sup>47</sup> Nicholes, 42.

<sup>48</sup> Environmental Science and Engineering, Inc., “Update of the Initial Installation Assessment,” 2-1, 2-3.

<sup>49</sup> Watson, “*Southern Triangle*,” 1, 2-24; Environmental Science and Engineering, Inc., “Update of the Initial Installation Assessment,” 2-3; Davidson, “Public Land”; Cannon v. United States of America.

<sup>50</sup> Arrington, “Supply Hub of the West,” 102; Arrington, “Anchors Aweigh in Utah,” 111.

<sup>51</sup> “Skull Valley Goshutes,” <http://www.skullvalleygoshutes.org/> (accessed 26 July 2006).

livestock industry required the most land. During the 1940s and 1950s, the U.S. Military and the livestock industry made incompatible concurrent claims to the West Desert.

The livestock industry never fully recovered during the 1930s from the ecological devastation of drought and overgrazing, but in the early 1940s some sheep operations made a significant recovery.<sup>52</sup> This was partly due to prices for wool and other sheep products rebounding because of the war.<sup>53</sup> Efforts made by the Soil Conservation Service, the Grazing Service, and the Civilian Conservation Corps in the 1930s, along with more favorable levels of precipitation, also helped the rangelands of the West Desert.<sup>54</sup>

Conservation efforts had tended to favor large sheep operations that owned land and had longstanding documented usage of rangelands and water resources. For example, the Deseret Live Stock Company (DLC), which had owned more land than any other livestock operations in the region and had documented usage of rangeland and water resources dating back to 1890, was awarded privileges to up to 268,920 acres of winter grazing land. This allowed the DLC to trail 40,000 to 45,000 sheep, a number that was only slightly below their pre-depression average.<sup>55</sup> The Grazing Bureau's ruling, along with the company's ability to "withstand major capital investments for new techniques,"

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<sup>52</sup> Nicholes, 48-49.

<sup>53</sup> Rondo A. Christenson and Stuart H. Richardson, *Utah Agricultural Statistics, Revised 1924-1965* (Logan: Utah State University, 1967), 142; Walter Dansie to Deseret Live Stock Company's Board of Directors, 1 May 1943, Deseret Live Stock Company Records, Box 3, Folder 11.

<sup>54</sup> Bluth, "Confrontation with an Arid Land," 163-165; Mayland, "Economic Geography of Utah's Sheep Industry," 153-154. Even with these conservation efforts sheepherders still had to commonly depend on supplemental feed to maintain their operations in the West Desert. For further details, see The Staff of the Utah Agricultural Experiment Station, "An Analysis of the Agricultural Situation in the Wasatch Front Area Resulting from War and Post-War Changes," in *After Victory Plans for Utah and the Wasatch Front* ed. Ora Bundy (Salt Lake City: Utah State Department of Publicity and Industrial Development, 1943), x, 33-34. For an account detailing the importance and difficulties of providing feed to sheep on the winter range, see Beltre, *Basque Sheepmen of the American West*, 157-169.

<sup>55</sup> For average number of sheep trailed by the DLC in the 1940s, see "A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1950 to December 31, 1951," Ernest L. Poulson Papers, ACCN 594, Box 1, Folder 18, Western Americana, J. Willard Marriott Library, University of Utah, Salt Lake City; "Statement of Dean W. Frischknecht," 20 June 1952, Deseret Live Stock Company Records, Box 4, Folder 6; Walter Dansie to Mr. C.F. Moore of Colorado, August 19, 1952, Deseret Live Stock Company Records, Box 4, Folder 6. For DLC's pre-depression average of sheep, see Moss, "The Deseret Live Stock Company," 3-4; McMurrin, *The Deseret Live Stock Company*, 7-8.

helped the DLC prosper.<sup>56</sup> In 1941 the DLC declared its first annual dividends since 1930. By the end of the decade the company was making record profits.<sup>57</sup> Small independent herders such as Nicholes came to believe that the DLC held “an empire of range.”<sup>58</sup> One DLC director reinforced this impression when he claimed in 1946 that the company had become the “undisputed giant of Utah’s sheep industry.”<sup>59</sup> The company’s advantages and success, however, did not immunize it from the effects of military development.

The exact consequences of the annexation of grazing lands in the West Desert are uncertain. In 1940, for example, some sheep operators believed that the development of Wendover Army Air Force Base would have removed around 150,000 head of sheep and several thousand head of cattle from the winter range, taking away an annual income estimated at \$1.5 million from the local livestock industry, but whether this occurred is unclear.<sup>60</sup> The majority of annexed lands were on salt flats that were “useless for the grazing of livestock”, so the actual loss may not have been as severe as some feared.<sup>61</sup> On the other hand, the Skull Valley rangelands annexed by the Army in the early 1950s were critical to grazing operations. Investigating how this loss affected the DLC--the most prominent and successful operation at the time—provides insight into how military annexation impacted the livestock industry.

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<sup>56</sup> Bluth, “Confrontation with an Arid Land,” 165.

<sup>57</sup> Moss, “The Deseret Live Stock Company,” 96; McMurrin, *The Deseret Live Stock Company*, 12. For record profits, see “A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1950 to December 31, 1951”;

<sup>58</sup> Nicholes, 74

<sup>59</sup> James Moyle, “The Deseret Live Stock Company,” (1946), Ernest L. Poulson Papers, ACCN 594, Box 1, Folder 18, Western Americana, J. Willard Marriott Library, University of Utah, Salt Lake City.

<sup>60</sup> No known studies have been conducted on the actual effects of military development on the livestock industry in the West Desert. For studies that report the predicted effects of military development on the livestock industry, see Eugene A. Correll, “Summit County,” 18 November 1940, Utah Writers Project, Utah Grazing Manuscripts, MS 9, Utah State University, Merrill-Cazier Library, Special Collections, Logan, 74-75; Arrington, “World’s Largest Military Reserve,” 326; Alexander, “Utah War Industry,” 76.

<sup>61</sup> James D. Moyle to Senator Elbert D. Thomas, 27 March 1950, Deseret Live Stock Company Records, Box 4, Folder 5.

In the early 1950s the Army received authorization to expand DPG from 268,400 acres to nearly 800,000 acres. In May 1950, the Army gave notice to the DLC that the “urgent interests of National Defense require exclusive use by the Chemical Corps, U.S. Army, of certain lands within the North Dugway and Skull Valley Units of the Utah Grazing District No. 2 now being used principally for grazing purposes by you and other livestock owners.”<sup>62</sup> The DLC considered these grazing units “very vital.” So did about fifty other local livestock operations.<sup>63</sup> DLC officials called the loss of range “a rank and costly injustice” and a “crippling blow” to their operations.<sup>64</sup> Walter Dansie, the general manager of the DLC at the time, blamed the “oppression and discrimination” of “the government Taylor Grazing Service.”<sup>65</sup> Dansie’s accusation was not unwarranted. The Taylor Grazing Act had been amended in 1948 to give the U.S. Military the ability to acquire public grazing land “for war or national defense purposes.”<sup>66</sup> This legitimized the defense industry’s claim over critical environmental resources in the name of national security. The legislation also granted the military the power to determine what constituted “fair and reasonable” compensation for losses suffered. Awards decided solely by the military were “deemed payment in full for such losses.”<sup>67</sup>

The military’s compensation offer to the DLC became a key source of contention. Grazing reductions were measured in the amount of forage required by an animal unit for one month, or an “AUM.” In Skull Valley, one cow generally counted as four animals

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<sup>62</sup> Col. F.S. Tandy to Deseret Livestock Company, 31 May 1950, Deseret Live Stock Company Records, Box 4, Folder 5.

<sup>63</sup> James D. Moyle to Senator Elbert D. Thomas, 27 March 1950.

<sup>64</sup> Ken Garff to Senator Arthur V. Watkins, 6 July 1953, Deseret Live Stock Company Records, Box 4, Folder 7; Marcellus Palmer, “Appraisal Report For Deseret Livestock Company, Inc.,” Deseret Live Stock Company Records, Box 4, Folder 8.

<sup>65</sup> Walter Dansie to Mr. C.F. Moore, 19 August 1952, Deseret Live Stock Company Records, Box 4, Folder 6.

<sup>66</sup> Before this amendment the statute, which was enacted in 1942, only said “for war purposes.”

<sup>67</sup> For further details, see Taylor Grazing Act, 43 U.S.C. 315 et seq. Section 315q, <http://uscode.house.gov/download/pls/43C8A.txt>.

units and, on the average, nine-tenths of a sheep made up one animal unit.<sup>68</sup> The total acreage of an AUM varied, however, based on the relative quality of forage. For the DLC's West Desert Grazing Allotment, each AUM averaged roughly five acres.<sup>69</sup> Prior to the annexation of the Skull Valley grazing units twenty-six livestock operations had privileges to a total of 92,772 AUMS. Of these twenty-six operations, the DLC controlled 58 percent of the AUMs. The Army annexed around 10 percent, or 9,272 AUMs, of the Skull Valley's grazing units for Dugway's expansion. The DLC's loss of 5,373 from a total of 53,825 AUMs fell in line with the 10 percent average reductions and thus represented 58 percent of all land lost to annexation.<sup>70</sup> The Army offered an average payment of \$10.08 for each Skull Valley AUM, yet the DLC was offered only \$6.51 per AUM for a total proposed offer of \$35,000. A settlement offer at the average price of \$10.08 by contrast would have been \$54,160. Even this was considered to be well below market value, which the DLC estimated at \$22.91 per AUM.<sup>71</sup>

The Army argued that a "just compensation [had] been *reasonably and fairly* determined," yet grazers demurred.<sup>72</sup> DLC officials such as Ken Garff, who became the company's new president in 1953, argued that for "most of the operators, the whole settlement was entirely inadequate, but in the case of Deseret Live Stock Company, it was both inadequate and discriminatory."<sup>73</sup> Even "after more than two years of negotiation, appeals and contention," frustrated company officials were still "unable to

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<sup>68</sup> These figures are calculated from the average AUMs and total sheep owned by 46 sheep operations in the Skull Valley and North Dugway region, see "Summary of Grazing Permit Reduction-Skull Valley and North Dugway Units," Deseret Live Stock Company Records, Box 4, Folder 9.

<sup>69</sup> "Summary of Grazing Permit Reduction"; "Deseret Livestock Company v. The U.S. Government," 2.

<sup>70</sup> The majority of sheep operations lost an average of 10 percent, but there were a few notable exceptions, see "Summary of Grazing Permit Reduction."

<sup>71</sup> "Deseret Livestock Company v. The U.S. Government," 7-8.

<sup>72</sup> Col. District Engineer K.M. Moore to the Deseret Livestock Company, 25 May 1951, Deseret Live Stock Company Records, Box 4, Folder 5 (my italics); Geo H. Walker to Walter Dansie, 10 December 1952, Live Stock Company Records, Box 4, Folder 6.

<sup>73</sup> Ken Garff to Senator Arthur V. Watkins, 6 July 1954.

get any basic information as to how the Corps' appraiser [George Mathis] arrived at the severance damages in various costs." As a result, Garff felt that "the treatment accorded us by the U.S. Army Corps of Engineers has been unfair, discriminatory, arbitrary, capricious, and the result outrageous."<sup>74</sup> Unsurprisingly, the DLC refused to accept the Army's offer of \$35,000, reasoning that a just offer that compensated "the real damage" to the company would exceed this amount by "several times."<sup>75</sup>

The damages to the company were likely severe. The most evident sign of harm was in the bottom line. The DLC recorded high earnings in 1951, with a net income of \$636,864 all but \$14,443 of which came from livestock operations.<sup>76</sup> In the first two years after the military appropriated Skull Valley, the company's net income from livestock operations dropped to \$144,799 in 1952 and then \$76,303.76 in 1953.<sup>77</sup> Such meager earnings did not cover the company's annual operating costs, resulting in losses of nearly \$100,000 in 1953.<sup>78</sup> The military annexation was not, however, the only factor contributing to decline. There was considered to be "an abundance of moisture" on the West Desert ranges in March of 1952, but by fall 1953 drought had hurt many livestock operations.<sup>79</sup> The DLC had also recently invested in a salt production operation that proved unprofitable.<sup>80</sup> The most significant factor, besides the loss of grazing lands, was

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<sup>74</sup> Ken Garff to Senator Arthur V. Watkins, 6 July 1954.

<sup>75</sup> David A. Peterson to Harlan Watkins, 7 December 1953, Deseret Live Stock Company Records, Box 4, Folder 7.

<sup>76</sup> Moss, "The Deseret Live Stock Company," 83-84; "A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1952 to December 31, 1953," Ernest L. Poulson Papers, ACCN 594, Box 1, Folder 18, Western Americana, J. Willard Marriott Library, University of Utah, Salt Lake City; Walter Dansie to Elder H.D. Moyle, 20 December 1951, Deseret Live Stock Company Records, Box 3, Folder 12.

<sup>77</sup> "A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1952 to December 31, 1953."

<sup>78</sup> "A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1952 to December 31, 1953."

<sup>79</sup> "A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1950 to December 31, 1951"; David A. Robinson to Dugway Proving Ground's Commanding Officer, 14 December 1953, Deseret Live Stock Company Records, Box 4, Folder 7.

<sup>80</sup> In 1952 the salt operation caused the company to loss nearly \$30,000. For further details, see "A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1952 to December 31,

plummeting market prices.<sup>81</sup> The loss of Skull Valley grazing units was a key blow, but it was hardly the only force working against the DLC.

The annexed area was critical to transhumance operations. Its higher elevation received greater amounts of precipitation than farther west. Dean W. Frischknecht, a sheep foreman for the DLC in the 1950s, felt “the range we lost was the choicest we had available for wintering our sheep which have been averaging some 45,000.”<sup>82</sup> William Sorenson, a former sheep foreman who had worked for the DLC since 1913, said the company grazed nearly 10,000 sheep on the lost range. It was “the best feed ground on the whole range representing at least a full 20 [percent] of our total winter range feed capacity.”<sup>83</sup> Perhaps of more importance than the lost forage were the reduced water resources. Among these was Cane Springs, considered “the finest [spring] in Skull Valley for its purpose.” The spring had been continuously used by the company for over sixty 60 years and was crucial to sheep operations on the arid rangelands of the West Desert, but was “now under Dugway proving grounds’ fence and lost to [the DLC] permanently.”<sup>84</sup>

These were a few examples of the direct losses the DLC suffered. Loss of range had many indirect consequences as well. The winter range, as noted, was a crucial link to

1953”; McMurrin, *The Deseret Live Stock Company*, 12, 14; Cooley, “Register of the Records of the Deseret Live Stock Company,” 4.

<sup>81</sup> A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1952 to December 31, 1953”; Prices for sheep dropped from \$13.90 per 100lbs to \$9.70 in 1952 and to \$6.50 in 1953. For lamb, prices dropped \$30.20 per 100lbs in 1951 to \$23.30 in 1952 and to \$17.10 in 1953. For further details, see Christenson, *Utah Agricultural Statistics*, 144.

<sup>82</sup> “Statement of Dean W. Frischknecht,” 20 June 1952.

<sup>83</sup> By 1952 the DLC had begun argue that their loss actually constituted around 20% of their West Desert feed capacity even though only 10 percent of their AUMs had been taken away. For further details, see “Statement of William H. Sorenson” 26 June 1952, Deseret Live Stock Company Records, Box 4, Folder 6; Walter Dansie to J. Kent Giles, Range Manager, September 22, 1952, Deseret Live Stock Company Records, Box 4, Folder 6; Walter Dansie to Mr. Farrington R. Carpenter, 9 October 9, 1952, Box 4, folder 6; Walter Dansie to Harlan B. Watkins, 1 July 1952, Deseret Live Stock Company Records, Box 4, Folder 6; “Statement of Dean W. Frischknecht,” 20 June 1952;

<sup>84</sup> David A. Robinson to U.S. Army Corps of Engineers, [13 October] 1953, Deseret Live Stock Company Records, Box 4, Folder 7. The DLC had an estimate made that stated the cost to develop a similar amount of water in Skull Valley would be approximately \$10,000. For further details, see David A. Robinson to U.S. Army Corps of Engineers, [13 October] 1953; Walter Dansie to Mr. Farrington R Carpenter, 9 October 1952, Deseret Live Stock Company Records, Box 4, Folder 6.

a larger ranch consisting of a complex yet balanced “collection of operating units varying in seasonal uses” that took the company over sixty years to build.<sup>85</sup> No unit could “be sold and replaced on the spur of the moment without loss of value.” Each was a “link in a chain and its loss or weakening immediately reduces the use and value of the remaining parts.”<sup>86</sup> Thus to remain solvent, the DLC either had to cut the size of its privately-owned rangeland and reduce its herds or find a way to replace the lost winter range.<sup>87</sup> In the first year after annexation, the DLC spent \$50,220.00 to transport 4,050 head of sheep to California feedlots from November 1951 to May 1952.<sup>88</sup> The company also spent another estimated \$14,000 to maintain 2,700 ewes on their Skull Valley ranch and to lease range permits from a local livestock operator.<sup>89</sup> These measures sustained operations but ate severely into profits.<sup>90</sup> In July 1952, Dansie noted to the Army that the DLC had been “damaged to a far greater extent than was apparent to anyone except ourselves.”<sup>91</sup> He wrote: “If it were not for all these combined items [the above measures] we could not have maintained our normal numbers, which would have been fatal to our operations because of our overhead expense. These same circumstances may not present themselves again so favorably, and the problems of securing feed annually will ever be present.”<sup>92</sup>

By fall 1952, the company’s economic situation had worsened. Poor markets and other factors had depressed profits, but company officials felt the loss of grazing land was

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<sup>85</sup> “Deseret Livestock Company v. The U.S. Government,” 1.

<sup>86</sup> Palmer, “Appraisal Report for Deseret Livestock Company, Inc.”; “Deseret Livestock Company v. The U.S. Government,” 1.

<sup>87</sup> “Deseret Livestock Company v. The U.S. Government,” 3.

<sup>88</sup> For figure and dates, see “Deseret Livestock Company v. The U.S. Government,” 6.

<sup>89</sup> Walter Dansie to Harlan B. Watkins, 1 July 1952. Unlike with the other expenses, the company did not provide receipts for these two purchases in their appeals to the Army.

<sup>90</sup> “A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1950 to December 31, 1951.”

<sup>91</sup> Walter Dansie to Harlan Watkins, 1 July 1952.

<sup>92</sup> Walter Dansie to Harlan Watkins, 1 July 1952.

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still the key problem. In September 1952, Dansie noted to the local range manager of the Bureau of Land Management how “this last 20 [percent] decrease to the Dugway Proving Ground is just about the last straw. Unless we get some relief it appears that we will be forced out of business.”<sup>93</sup> Dansie’s desperation stemmed partly from the company’s inability to secure rangeland for the 1952-1953 winter season. The following month the DLC decided to purchase 118,480 acres of land and 2341 AUMs of public domain in an area west of Wendover for approximately \$121,360.00, but this range did not equal the quality of resources on the Skull Valley range.<sup>94</sup> The cost also exceeded the Army settlement offer by several fold and transportation expenses from company headquarters to these distant ranges further burdened operating expenses.<sup>95</sup>

The combined costs of at least \$185,580 to replace the lost range damaged the company.<sup>96</sup> 1952 earnings from livestock operations declined 77 percent from 1951 earnings. The drop in prices for sheep products in 1952 was a significant blow, but the high costs of replacement range—an expense which far exceeded the Army’s \$35,000 settlement offer—was the hardest setback.<sup>97</sup>

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<sup>93</sup> Walter Dansie to J. Kent Giles, 22 September 1952.

<sup>94</sup> The company paid \$16.39 per AUM on the new range which was significantly more than the \$6.51 the Army paid for the arguably more valuable Skull Valley range. For further details on this transaction, see “Deseret Livestock Company v. The U.S. Government,” 4, 6-7. The figures the DLC presented to the Army for this purchase were a source of contention, but both parties came to agree that \$121,360.00 was representative of the minimum cost to the company, see Marcellus Palmer to Walter Dansie, 26 May 1953, Deseret Live Stock Company Records, Box 4, Folder 7; David A. Robinson to Harlan B. Watkins, 7 December, 1953, Deseret Live Stock Company Records, Box 4, Folder 7.

<sup>95</sup> “Deseret Livestock Company v. The U.S. Government,” 6-7; David A. Robinson to Harlan B. Watkins, 7 December 1953; Walter Dansie to Col. Henry Walsh, October 31, 1952. According to estimates made by the DLC, 107,400 of the company’s AUMs were affected by the annexation of Skull Valley land, which represented a total value of \$2,461,250.00. For further details, see “Deseret Livestock Company v. The U.S. Government,” 8.

<sup>96</sup> “A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1952 to December 31, 1953.” This figure is totaled from the expenses of shipping sheep to California and buying the range in Nevada. It does not include loss of investment in resources on the Skull Valley range, the additional operating costs to herd sheep in Nevada, the decline in sheep numbers, or the legal fees spent in challenging the Army’s appraisal offer.

<sup>97</sup> In 1950 prices for sheep and lamb were below 1952 prices, yet 1950 earnings for the DLC were over \$300,000. For further details, see “A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1950 to December 31, 1951”; Christenson, *Utah Agricultural Statistics*, 144.

Walter Dansie and other DLC directors warned that the company was at risk of going out of business due to the annexation.<sup>98</sup> Through the first half of 1953 DLC livestock operations continued to suffer losses, putting the company in a desperate situation that likely forced a radical transformation.<sup>99</sup> In July 1953, a syndicate of wealthy business associates headed by entrepreneur Ken Garff gained control of the DLC by gradually purchasing the majority of the destabilized company's stock.<sup>100</sup> This takeover signaled an end of management and control by members of the original founding families. A closely-knit group of directors who had managed the company for nearly three generations was replaced by Garff's associates and family.<sup>101</sup> During the takeover, scores of relatives and associates also lost or sold their stock in the company. Thus by late summer 1953 the DLC had been severed from its origins.<sup>102</sup> How much the company's desperate financial situation enabled Garff and his associate's to gain control of the company is difficult to determine, especially since the reasons behind the sell out remain unclear. The closely knit group of DLC directors had withstood many obstacles during the company's sixty years of operations, including the Great Depression and several severe droughts. Thus the takeover probably could not have happened except

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<sup>98</sup> Walter Dansie to J. Kent Giles, 22 September 1952; James D. Moyle to Senator Elbert D. Thomas, 27 March 1950; Palmer, "Appraisal Report for Deseret Livestock Company, Inc.," Alden S. Adams, Ranch Salesmen of the Ed Lewis Company, to DLC C/O Walter Dansie, 10 June 1952, Deseret Livestock Company Records, Box 4, Folder 6; "Statement of Dean W. Frischknecht," 20 June 1952; "Statement of William H. Sorenson," 26 June 1952.

<sup>99</sup> In 1953 the company also was forced to reduce their sheep from 41,108 to 35,294, but the exact time when this reduction took place is uncertain. For further details, see "A Comparative Summary of the Financial Operations of the Deseret Live Stock Company from December 31, 1952 to December 31, 1953"; David A. Robinson to Dugway Proving Ground Commanding Officer, 14 December 1953.

<sup>100</sup> Since its inception, control of the DLC was held by the individuals who owned the most stock. For further details on the takeover of the company, see McMurrin, *The Deseret Live Stock Company* 14; Moss, "The Deseret Live Stock Company," 96-97; Cherie Voss, "The Story of the Deseret Livestock Company," (1971), Ernest L. Poulson Papers, ACCN 594, Box 1, Folder 17, Western Americana, J. Willard Marriott Library, University of Utah, Salt Lake City.

<sup>101</sup> Moss, "The Deseret Live Stock Company," 96-97; Voss, "The Story of the Deseret Livestock Company"; Walter Dansie to Ken Garff, "Letter of Resignation," [July 1953], Deseret Live Stock Company Records, Box 29, Folder 1.

<sup>102</sup> Stockholders increased from 95 in 1891 to 250 in 1928-1929 to 275 in 1952. These stockholders were mostly descendents of the original incorporators. The number of stockholders dropped to 65 after the company was taken over in 1953. For further details, see Moss, "The Deseret Live Stock Company," 97; Walter Dansie to Harlan B. Watkins, 1 July 1952.

under extreme hardships. Many directors, moreover, were in the prime of their careers and there was no indication that they were not looking forward to turning the company over to their progeny, just as their forebear's had done.<sup>103</sup>

In any case, the change of management did not end the legal battle with the Army. Over the course of four years, old and new owners alike made a number of time-consuming and costly requests for reappraisals.<sup>104</sup> These requests were summarily rejected by the Army, which maintained that their original offer fell under the authority of the 1948 amendment and that “under existing law no authority exists for reimbursement in an amount in excess of \$35,000.00 for extinguishment of the Deseret Livestock Company grazing privileges in the public domain within the Dugway Proving Ground, Utah.”<sup>105</sup> When the DLC asked Edward W. Clyde, a leading authority on natural resource laws, to interpret the significance of this statement, Clyde feared “there is no way you can compel them to pay more.”<sup>106</sup> In March 1954, the new owners decided to “take what the Army will give us rather than fight what looks like a losing battle which may be stretched out over a period of several years.”<sup>107</sup> They were “hard pressed for money” and had been “forced to borrow heavily to operate,” so they concluded that they had “spent more than we could afford to spend in handling this case” and that they could

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<sup>103</sup> Moyle, “The Deseret Live Stock Company”; Voss, “The Story of the Deseret Livestock Company”; Moss, “The Deseret Live Stock Company,” 5-7, 96-97. Interestingly, James R. Moss would have likely inherited a position in the company from his father James H. Moss, who was a company director from 1933-1953, but instead he wrote an MA thesis on the early history of the company in 1965.

<sup>104</sup> Palmer, “Appraisal Report for Deseret Livestock Company, Inc.”; Walter Dansie to Colonel Henry Walsh, 31 October 1952, Deseret Live Stock Company Records, Box 4, Folder 6; David A. Robison to F.R. Carpenter, 2 June 1953, Deseret Live Stock Company Records, Box 4, Folder 7; Ken Garff to Jesse B. Witty, 30 September 1953, Deseret Livestock Company, Box 4, Folder 7; David A. Robinson to Harlan B. Watkins, 7 December, 1953; Deseret Live Stock Company to Ernest L. Wilkinson, 13 October 1953, Deseret Livestock Company, Box 4, Folder 7.

<sup>105</sup> Colonel Henry Walsh to the Deseret Livestock Company, 3 October 1952, Deseret Live Stock Company Records, Box 4, Folder 6; Col. Geo. H. Walker to Walter Dansie, 10 December 1952; Harlan B. Watkins to the Deseret Livestock Company, 19 June 1953, Deseret Live Stock Company Records, Box 4, Folder 7.

<sup>106</sup> Edward W. Clyde to Marcellus Palmer, 8 October 1952, Deseret Livestock Company Records, Box 4, Folder 6.

<sup>107</sup> David A. Robison to F.R. Carpenter, 16 March 1954, Deseret Live Stock Company Records, Box 4, Folder 7.

not “afford to fight the thing for another two or three years in the faint hope of getting more.”<sup>108</sup>

The DLC possessed more resources and influence than any other livestock operation in the West Desert, yet this corporation could not resist military annexation or compel adequate compensation. This was not only because laws favored the defense industry but also because most residents in the Bonneville Basin supported military development. National security was big business. In Tooele County, many locals actively supported the 1950s expansion of Dugway because it brought jobs to the West Desert, a region that had become highly dependent on the defense industry.<sup>109</sup> As with Camp Floyd nearly a hundred years earlier, residents in the Bonneville Basin welcomed the economic benefits that came from the defense industry even if it hurt certain segments of the population.

### Conclusion

The 1940s and 1950s were times of transition and contention in the West Desert. Wartime weapons testing was conducted under a sense of urgency and focused on specific tactical problems. Both inside and outside of the new military installations’ boundaries, lands that only a few years before had teemed with sheep and shepherds were reduced to stages for practicing war. Weapons tests were justified by their contribution to the Allied war effort, but success came at a cost. In the Yellow Jacket Area, the Army bombed “the hell out of” numerous mines and left behind a remarkable amount of

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<sup>108</sup> David A. Robison to F.R. Carpenter, 16 March 1954.

<sup>109</sup> Clayton, “An Unhallowed Gathering,” 231; Carrier, “The West Desert”; Yvette D. Ison, “Chemical Weapons Testing Created Controversy at Dugway,” *Utah History to Go*, [http://historytogo.utah.gov/utah\\_chapters/utah\\_today/chemicalweaponscreatedcontroversyatdugway.html](http://historytogo.utah.gov/utah_chapters/utah_today/chemicalweaponscreatedcontroversyatdugway.html) (accessed 21 May 2007); From 1950 to 1955, Tooele County’s labor force increased from 5,500 to 7,500. This increase was largely due to Cold War military development, see Elroy Nelson, *Utah’s Economic Patterns* (Salt Lake City: University of Utah Press, 1956), 14-16.

hazardous materials.<sup>110</sup> In the Southern Triangle, a heavily-used sheep trail turned into a minefield of unexploded ordnance containing highly lethal substances. The danger these testing activities presented to local wildlife, plant communities, and natural resources remains difficult to ascertain, largely because the people who conducted the weapons tests did not consider such questions. What is known is that military activities conducted in support of national security made areas of the West Desert extremely hazardous, especially to those people who had previously relied on the region's natural resources.

National security concerns also gave the military's environmental claims top priority, allowing it to annex critical resources at will. The appropriation of land was a near "crippling blow" to the most prominent, successful, and longstanding livestock operation in the Bonneville Basin. The "undisputed giant of Utah's sheep industry" went from near record profits in 1951 to severe losses when the Army began to restrict sheep from DPG's expanded boundaries in 1952 and 1953.<sup>111</sup> Many factors contributed to the DLC's decline, but behind Dugway's new fences were critical grazing resources that the DLC had invested in and relied upon for generations. The lost rangeland, moreover, was a crucial link in a much larger livestock operation. To maintain operations, the company was forced into costly purchases to replace the annexed range. In the end, the DLC's extensive private rangeland, which had helped them gain advantageous grazing privileges under the Taylor Grazing Act, also made them vulnerable. The forced annexation without due compensation damaged their business, just as the Taylor Grazing Act had "wiped those small outfits out everywhere" by forcing them off the range in the 1930s.<sup>112</sup> Likely many of the remaining and already marginal small sheep operations that lost grazing

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<sup>110</sup> Davidson, "Army Tests Ravaged Family's Land"; Cannon v. United States of America.

<sup>111</sup> Moyle, "The Deseret Live Stock Company."

<sup>112</sup> Nicholes, 5.

privileges to Dugway were able to more easily adjust to the loss, since it was just one of many adjustments they had been forced to make after the enactment of the Act. The DLC had not been marginalized in the 1930s. Their loss in the early 1950s was far more than any other operation. The remarkable success they experienced in the 1940s came to an abrupt end in the early 1950s.

After the mid 1950s, few West Desert sheep operations, big or small, prospered. Sheep numbers in the West Desert had declined since the early 1930s, but there were temporary rebounds during the 1940s and early 1950s. After 1953, though, there was a steady and interminable decline.<sup>113</sup> By 1968 sheep were still raised in the West Desert but the industry's economic importance had diminished significantly. Most notably, by the late 1960s sheep numbers had declined approximately 70 percent from what they had been in the early 1930s.<sup>114</sup> The DLC, whose new owners focused more on raising cattle and using their vast land holdings as private hunting preserves, discontinued sheep operations in the mid 1970s.<sup>115</sup> Military development was a factor in this decline, though not the most important one. Other factors like better prices for beef than lamb, the development of synthetic fibers, and higher operating costs were instrumental to the gradual decline of the industry after the 1950s.<sup>116</sup> Along with this decline came a loss of memory. The role that the West Desert had in the development of the sheep industry and the substantial impact this industry had in shaping the communities of the Bonneville Basin were widely forgotten. Modern accounts depict the military taking over

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<sup>113</sup> Christenson, *Utah Agricultural Statistics*, 141-142.

<sup>114</sup> Utah State Department of Agriculture, *Utah Agricultural Statistical Report, 1971*, Utah State University, Merrill-Cazier Library, Bookshelves, Logan, 60; Goodsell, "Costs and Returns," 1; Christenson, *Utah Agricultural Statistics*, 142.

<sup>115</sup> Moss, "The Deseret Live Stock Company," 97; McMurrin, *The Deseret Live Stock Company*, 14-14; Cooley, "Register of the Records of the Deseret Live Stock Company," 4.

<sup>116</sup> Goodsell, "Costs and Returns," 1; Mayland, "Economic Geography of Utah's Sheep Industry," 152-164; Nelson, *Utah's Economic Patterns*, 56.

unproductive and isolated lands that were home to extremely marginal groups of Native and Euro Americans.<sup>117</sup> This clipped history may have been the ultimate costs in the military and livestock industry's contestation over West Desert resources, but it was also a history still in progress.

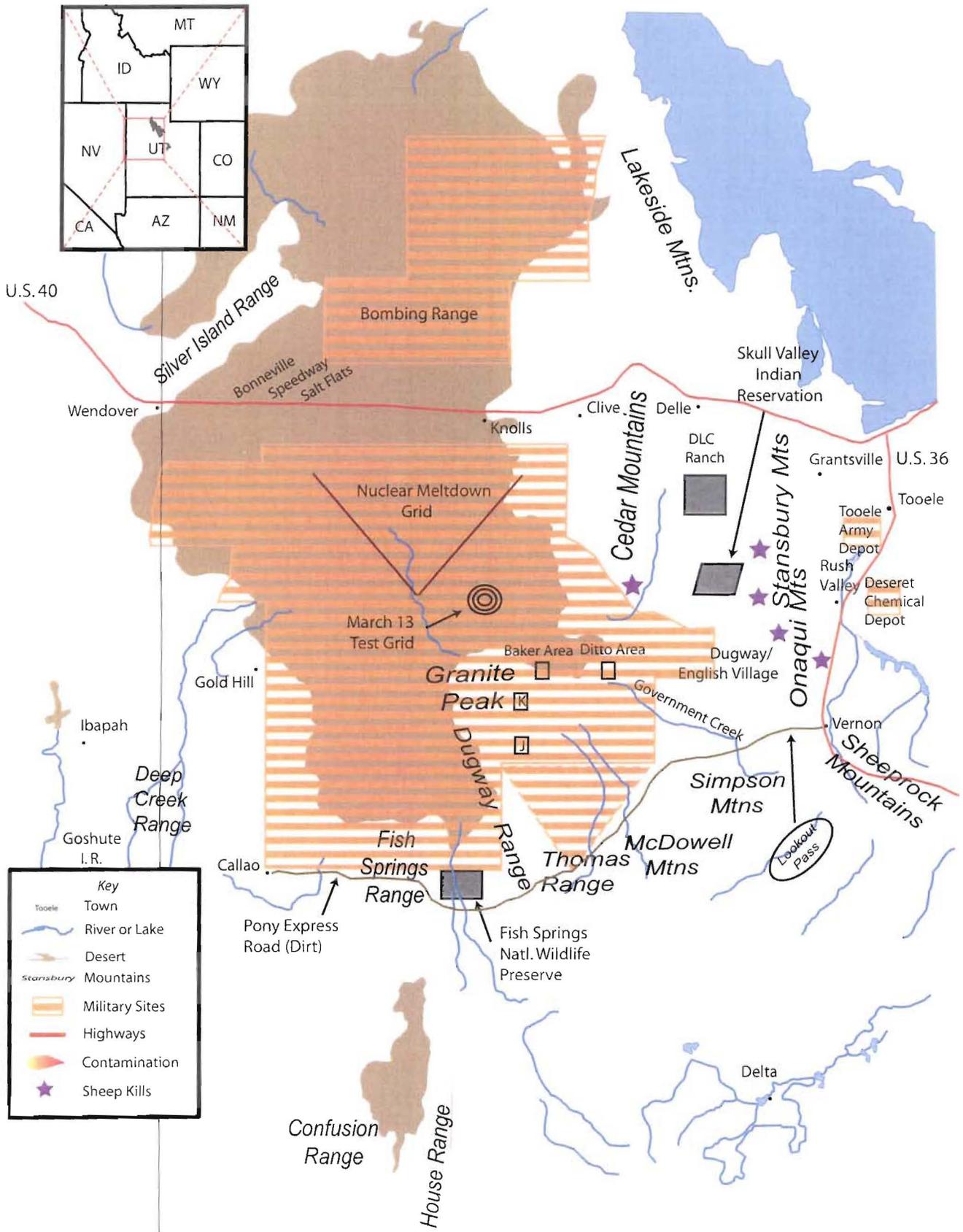
World War II was just the beginning of modern military activity in the West Desert. Defense-related activities expanded greatly in the 1950s and 1960s. The Army began an "intense period" of CBR weapons testing at Dugway, and the relatively benign impact of the research during the 1940s rapidly changed in the coming decades.<sup>118</sup>

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<sup>117</sup> For examples, see Arrington, "Sentinels on the Desert," 33-34; Ward, *Canaries on the Rim*, 45-46; Davis, "Dead West"; Carrier, "The West Desert"; Mike Boyd, "The History of Dugway Proving Ground," *Test Run (Dugway)*, 24 February 1967, L. Tom Perry Special Collection Library. Harold B. Lee Library, Brigham Young University, Provo..

<sup>118</sup> Dugway, "Final Environmental Impact Statement," 1-16.

# Map 4: Cold War Weapons Testing



## CHAPTER III

### FIFTY WAYS TO KILL A SHEEP: WEAPONS TESTING IN THE WEST DESERT

#### Introduction

In the aftermath of World War II, justifications for chemical, biological, and radiological (CBR) weapons research and development shifted from immediate strategic wartime problems to vague and ubiquitous threats to national security. The Army's Chemical Corps' (formerly the Chemical Warfare Service) new emphasis resulted in an intense period of testing at Dugway from 1951 to 1969. This prolific Cold War program was internally regulated and received little oversight from public or private groups outside the Department of Defense. The Army's ability to monitor safety, however, was inadequate. Cold War weapons testing presented perilous threats to the local environment and population. This was most evident in March 1968, when unfavorable weather conditions and a mechanical malfunction caused VX nerve agents to spread beyond the proving ground's eastern boundary and kill thousands of sheep in Skull Valley.

It was a horrific event, but evidence suggests that there was nothing unusual about that one aerial test. Records indicate that during the Cold War period accidents and malfunctions occurred repeatedly, weather conditions were disregarded, tests were sometimes conducted in a cavalier manner, and CBR warfare material often did not make it to the test grid. The March 1968 aerial test simply demonstrated what could happen when several operational shortcomings occurred simultaneously. Nearly all CBR weapons tests were dangerous, but the unpredictable consequences of releasing live pathogens into the open-air made biological weapons (BW) tests likely the most hazardous activity performed at Dugway. As with other testing, safety protocols and

oversight measures for BW testing were inadequate, but tracing these risks remains immensely difficult because the differences between manufactured and natural pathogens are difficult to distinguish. Nonetheless, the Army's BW and other testing programs, all of which were designed to ensure national security, instead presented insidious threats to the American public. Just as early shepherders would not use ecologically sustainable grazing strategies without federal enforcement, the Army's ecologically dangerous testing operations also demanded federal oversight.

### **Cold War Weapons Testing Policy**

After the war the justification for CBR weapons testing changed. The tangible problems of warfare gave way to vague threats to national security, including vulnerability to Soviet chemical and biological weapons (CBW) attacks. A 1951 intelligence report described how Soviet saboteurs carrying biological agents could enter “undetected through the porous borders of the US and would establish sleeper cells, eluding detection until they were prepared to strike at personnel, animals, or crops.”<sup>1</sup> Another report described how such an attack could kill or incapacitate “a significant portion of the human population within selected target areas” with only a small amount of biological agents. Even ventilating systems, water supplies, “stamps, envelopes, money and cosmetics” might be used to disseminate biological agents.<sup>2</sup> In 1950 the CIA raised similar fears about Soviet CW capabilities, noting that the Soviets supposedly had “sufficient nerve gas for sustained extensive employment.” By 1954 they would likely have “new agents in sufficient quantity for limited mass lethal attacks on selected

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<sup>1</sup> John Ellis van Courtland Moon, “The U.S. Biological Weapons Program,” in *Deadly Cultures: Biological Weapons since 1945*, eds. Mark Wheelis, Lajos Rózsa, and Malcolm Dando (Cambridge: Harvard University Press, 2006), 16.

<sup>2</sup> I.L. Baldwin, Chairman Committee on Special BW Operations, Memorandum for the Research and Development Board of the National Military Establishment, Washington, D.C., 5 October 1948, Truman Library quoted in Moon, “Weapons Program,” 15.

military or industrial targets in the U.S.” The report also discussed the potential for covert attacks with nerve agents, observing that “since the agents are odorless, colorless liquids, they can be transported in glass or suitably lined containers” and “shipped in any desired quantity disguised as innocuous liquids, such as champagne or perfume.”<sup>3</sup>

These Cold War fears provided a new justification for CBR weapons research and development (R&D). As H.A. Kuhn, the former president of the Armed Forces Chemical Association, noted in 1952:

in the past the military expansion has been made under urgency of a shooting war with the object of winning the war as soon as possible, and return to a peacetime economy. The job today is bigger, the end not so visible.... We are arming today, not necessarily to fight a war but to prevent the most devastating war in all of history.”<sup>4</sup>

Prevention became the keystone of U.S. foreign policy during the Cold War. Deterrence was achieved primarily “by the threat of retaliation in kind.”<sup>5</sup> An adequate retaliatory capacity required “an aggressive research and development program designed to provide the military with a wide range of [chemical and biological] weapons of maximum effectiveness.”<sup>6</sup>

The robust R&D program necessitated changes in federal policies toward CBW. While the U.S. had not ratified the 1925 Geneva Protocol banning the use of CBW, Franklin D. Roosevelt stated in 1943 that America would “under no circumstances resort

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<sup>3</sup> National Intelligence Estimate: DCI, National Intelligence Estimate no. 18, The Probability of Soviet Employment of BW and CW in the Event of Attacks Upon the US, 15 December 1950, NARA quoted in Tucker, *War of Nerves*, 129.

<sup>4</sup> H.A. Kuhn, “The Chemical Industry and National Defense,” *AFCJ* 6 (July 1952): 34-35 quoted in Russell, *War and Nature*, 185.

<sup>5</sup> Denis Orphan, “Chemical, Biological, Radiological Attack: The Three Deadly Faces of Modern Warfare,” (March 1961) in *Orientation Folder*, ed. U.S. Army Test & Evaluation Command (Dugway, UT: U.S. Army Test & Evaluation Command, 1964), Pam 8294, Utah State Historical Research Society, Salt Lake City; House Hearings, *Environmental Dangers*, 129.

<sup>6</sup> Orphan, “Modern Warfare.”

to the use of such weapons unless they are first used by our enemies.”<sup>7</sup> In the five years following WWII, a number of intelligence reports found that this no-first use policy impeded efforts to combat the Soviet threat.<sup>8</sup> The most influential criticism was the 1950 Stevenson Committee Report, which claimed that Roosevelt’s retaliation-only policy had “resulted in the assignment of low priorities to the research, development, and production” of CBW. “The security of the United States,” it noted, “demands that the policy of ‘use in retaliation only’ be abandoned.”<sup>9</sup> The report also advocated a more aggressive use of CBW, noting that “the United States should be prepared to defend itself against biological warfare and to wage biological warfare offensively.” Chemical weapons were also “exceedingly important as a supplement to weapons now in general use for holding back the advance of enemy ground forces.”<sup>10</sup>

The committee submitted its report five days after North Korea’s invasion of South Korea, thus heightening its political impact. The Joint Chiefs of Staff and Secretary of Defense George C. Marshall accepted nearly all of the report’s recommendations. The exception was the proposed abandonment of the retaliation-only policy.<sup>11</sup> They thus essentially blurred the line between offensive and defensive research while maintaining the no first use policy. Six years later, in March 1956, a classified memorandum on “Basic National Security Policy” prepared by the staff on the National Security Council finally abandoned the retaliation-only position by granting the president power to initiate a CBW

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<sup>7</sup> Samuel I. Rosenman, ed., *The Papers and Addresses of Franklin D. Roosevelt*, vol. 12: 1943: *The Tide Turns* (New York: Harper, 1950), 243 quoted in Russell, *War and Nature*, 109.

<sup>8</sup> Moon, “Weapons Program,” 30.

<sup>9</sup> “Report of the Secretary’s of Defense Ad Hoc Committee on Chemical, Biological, and Radiological Warfare,” 30 June 1950, iii-iv quoted in Tucker, *War of Nerves*, 126.

<sup>10</sup> “Report of the Secretary’s of Defense Ad Hoc Committee on Chemical, Biological, and Radiological Warfare,” 30 June 1950, iii-iv, RG 330 quoted in Moon, “Weapons Program,” 30 and Tucker, *War of Nerves*, 126.

<sup>11</sup> Joint Chiefs of Staff, 1837/14, September 7, 1950 [NARA, RG 218] as cited in Tucker, *War of Nerves*, 127.

attack.<sup>12</sup> Eisenhower remained committed to the policy of no-first-use however, approving the shift to “encourage research and development on chemical and biological weapons so as to ensure an adequate retaliatory capability.”<sup>13</sup>

The increased emphasis on the CBW research led to many new developments at Dugway. After being on standby status for four years, operations resumed in 1950 and, by 1954, the reserve was designated a permanent Army installation, which, in turn, required permanent residents. During WWII, personnel at Dugway had resided in rustic barracks and commonly referred to the post as “oblivion,” “limbo,” “Siberia” or “hell on earth.”<sup>14</sup> To make the installation more bearable the Army constructed permanent housing, shopping centers, churches, recreational facilities, and, eventually, a nine-hole golf course.<sup>15</sup> The new residential area, known today as English Village, was located on the southeast side of Cedar Mountain in what had been part of the Skull Valley and North Dugway Grazing Districts. An area once critical to grazing operations was transformed into a typical 1950s American suburb “with television antennas sprouting from comfortable housing units and housewives in treader pants rushing in and out of the shopping center.”<sup>16</sup> Testing and research activities at DPG also benefited from the development of biological testing facilities at the Baker Area, a meteorological research center, a medical detachment, and additional technical services.<sup>17</sup> All of these new developments supported Dugway’s prolific Cold War CBR weapons testing program.

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<sup>12</sup> NSC-5602/1: “Basic National Security Policy,” 15 March 1956 as quoted in Tucker, *War of Nerves*, 155-156 and Moon, “Weapons Program,” 12-13. Also, see Field Manual on Law and Land Warfare: SIPRI, CB Weapons Today, 195-196 quoted in Tucker, *War of Nerves*, 156.

<sup>13</sup> Tucker, *War of Nerves*, 155.

<sup>14</sup> Ronald Ives, “Dugway Tales,” *Western Folklore* 6 (January 1947): 53-58.

<sup>15</sup> Arrington, “Sentinels on the Desert,” 39; U.S. Army, “Dugway Proving Ground.”

<sup>16</sup> Arrington, “Sentinels on the Desert,” 39.

<sup>17</sup> U.S. Army, “Dugway Proving Ground.”

### Biological Weapons Testing at Dugway, 1951-1968

Of all the testing activities at Dugway, BW testing was likely the most dangerous. A number of studies have detailed different elements of Dugway's BW testing program, but they tend to focus on sensational aspects of the program.<sup>18</sup> Human test subjects or the massive scale of the tests tend to overshadow arguably the more widespread and lasting impacts of the program. The open-air testing of live pathogens gave rise to uniquely dangerous environmental hazards, which could cause "serious ecological imbalance, break natural food chains and disrupt environmental stability" over "wide-ranging areas."<sup>19</sup> The Army adopted strict safety protocols to alleviate these hazards, yet evidence suggests that their measures were ineffective. The material consequences, however, are difficult to ascertain because the Army's biological agents, which were no different from natural occurring pathogens, helped to create a thoroughly muddled hybrid disease ecology in the West Desert.<sup>20</sup>

Although deterrence was the primary motivation for developing BW capabilities, military strategists also liked their "tremendous possibilities" for covert "guerrilla forces operating behind enemy lines." The basic reason was etiological. The "distinction between this type of BW and naturally occurring outbreaks is most difficult," an Army

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<sup>18</sup> For a sampling of studies on BW testing, see; Leonard Cole, *Clouds of Secrecy: The Army's Germ Warfare Tests over Populated Areas* (Totowa, NJ: Rowman & Littlefield, 1988); Jeanne Guillemin, *Biological Weapons: From the Invention of State-Sponsored Programs to Contemporary Bioterrorism* (New York: Columbia University Press, 2005); Robert Harris and Jeremy Paxman, *A Higher Form of Killing: The Secret Story of Chemical and Biological Warfare* (New York: Hill and Want, 1982); Seymour M. Hersh, *Chemical and Biological Warfare: America's Hidden Arsenal* (New York: Bobbs-Merrill, 1968); Jeanne McDermott, *The Killing Winds: The Menace of Biological Warfare* (New York: Arbor House, 1987); Charles Piller and Keith R. Yamamoto, *Gene Wars: Military Control over the New Genetic Technologies* (New York: Beech Tree Books, 1988); Regis, *The Biology of Doom*, 165; Wheelis, "Deadly Cultures"; "The Living Weapon" *The American Experience*, Public Broadcasting Service, 5 February 2007, 8:00-9:00pm.

<sup>19</sup> House Report, *Environmental Dangers*, 45.

<sup>20</sup> For hybrid landscapes, see Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York: Hill and Wang, 1995); Richard White, "From Wilderness to Hybrid: The Cultural Turn in Environmental History," *The Historian* 66 (September 2004): 557-564; Fiege, *Irrigated Eden*. For the importance of disease in environmental history, see Valencius Conevery Bolton, *The Health of the Country: How American Settlers Understood Themselves and Their Land* (New York: Basic Books, 2002); Greg Mitman, "In Search of Health: Landscape and Disease in American Environmental History," *Environmental History* 10, (April 2005): 184-210.

scientist noted, so it could “be used with crippling results well in advance of the initiation of hostilities.”<sup>21</sup> That was the theory at least. Research at DPG in the 1950s was supposed to test these assumptions.

Dugway BW testing program had considerable latitude, including the development of decontamination procedures, detection devices, and protective equipment. Primarily, though, the program’s focus was on determining “the military value of BW and the amount and effectiveness of biological agent producible in the atmosphere by various delivery systems.”<sup>22</sup> From 1951 to 1968, Dugway hosted at least 328 field tests of BW.<sup>23</sup> Pathogens and toxins employed in these open-air test included: *Bacillus anthracis* (anthrax), *Yersinia pestis* (bubonic plague), *Francisella tularensis* (tularemia), *Coxiella burnetii* (Q Fever), *Chlamydia psittaci* (Parrot fever), *Brucella suis* and *Brucella melitensis* (undulant fever), *Coccidioides immitis* (valley fever), wheat stem rust, Vegetable Killer Acid, and botulism.<sup>24</sup> A number of simulants of pathogenic biological agents were also tested, such as *Bacillus subtilis* or *Serratia marcescens*, and biological agents like Newcastle Disease, Vesicular Stomatitis, Vesicular Exanthema, Melioidosis, Human Dysentery, Rocky Mountain spotted fever, and Tuberculosis were approved for testing but available records suggest that their use was restricted to laboratory work.<sup>25</sup>

<sup>21</sup> Report by the Joint Strategic Plans Committee to the Joint Chiefs of Staff on Statements of Policy and Directives on Biological Warfare, JCS 1837/34, 11 June 1952, 289 as quoted in Guillemain, *Biological Weapons*, 93.

<sup>22</sup> Moon, “Weapons Program,” 21; Dugway, “Final Environmental Impact Statement,” 1-17.

<sup>23</sup> United States Army Toxic and Hazardous Materials Agency, Report No. 140, “Installation Assessment of Dugway Proving Ground,” Report No. 140 (April 1979): 23-27, [http://home.comcast.net/~kknowlto/PDF/Assessment\\_DPG\\_79.pdf](http://home.comcast.net/~kknowlto/PDF/Assessment_DPG_79.pdf) (accessed 25 April 2007); “Weapons Testing Documents Listed for Dugway Proving Ground,” *Deseret News*, 17 December 1994; Lee Davidson “At a Glance: Weapons Testing Trends and Totals” *Deseret News*, 22 December 1994; Lee Davidson, “Cold War Weapons Testing,” *Deseret News*, 22 December 1994; Joe Bauman, “Defects, Distrust Left in Wake of Military Testing,” *Deseret News*, 12 February 2001.

<sup>24</sup> Army, “Installation Assessment,” 23-27; Parsons Engineering Science Inc., “Dugway Proving Ground, 2-29.

<sup>25</sup> Army, “Installation Assessment,” 23-27; Parsons Engineering Science Inc., “Dugway Proving Ground,” 2-18, 2-29.

In the early years of BW testing miniature cities were built on Dugway test grids and populated with rhesus monkeys and guinea pigs. These “cities” were then attacked with cluster bombs containing pathogens such as those that cause brucellosis.<sup>26</sup> By the mid 1950s the Chemical Corps shifted its research from cluster bombs, which had been only partly successful, to aerosol sprays.<sup>27</sup> The “St. Jo Program” demonstrated that aerosol spraying devices could successfully infect many animals and disperse the pathogen that causes anthrax “up to 40 miles downwind” at Dugway.<sup>28</sup> These tests demonstrated the potential effectiveness of aerosolized devices, but senior military personnel wanted evidence that aerosolized pathogens could infect humans.<sup>29</sup> Thus on 12 July 1955, thirty Seventh Day Adventist soldiers volunteered to populate a Dugway test grid and breathe in aerosolized clouds containing the pathogens that cause Q fever, a disease that could cause flu-like symptoms for one to three weeks and had a 1 to 2 percent mortality rate.<sup>30</sup> The test successfully illustrated the aerosolized agent’s virulence on humans, so the next step was to increase the scale. An aerial spray test at Dugway using Q fever in 1958 hypothetically “proved that airborne BW attacks could be carried out at low levels, and that a properly designed spray system could contaminate 50,000 square miles with BW aerosol in a single sortie....causing more than half the people in

<sup>26</sup> *Operational Suitability of a BW Munition*, Dugway Proving Ground Report 134 (BW 16-52), Dugway Proving Ground, Utah, 29 January 1954; redacted edition of secret documents; U.S. Army Dugway Proving Ground Archives, Ft. Belvoir, Virginia: Defense Technical Information Center: AD 366396 as quoted in Regis, *The Biology of Doom*, 138-143, 154-155. Also, see Moon, “Weapons Program,” 22-23; Guillemin, *Biological Weapons*, 98-101; “The Living Weapon.”

<sup>27</sup> Guillemin, *Biological Weapons*, 101-104; Moon, “Weapons Program,” 24-25.

<sup>28</sup> Dr. Henry Stubblefield, “Assessment of the BW Effort,” 1959, p. 28, RG 175, National Archives Research Administration, college Park, Md. quoted in Moon, “Weapons Program,” 25. For further details on the St. Jo Program, see Cole, “*Clouds of Secrecy*”; Guillemin, *Biological Weapons*, 101-104; Moon, “Weapons Program,” 24-25.

<sup>29</sup> Regis, *The Biology of Doom*, 165; Guillemin, *Biological Weapons*, 105-106; Moon, “Weapons Program,” 25-26; “The Living Weapon.”

<sup>30</sup> For further details on this test, see Regis, *The Biology of Doom*, 3-6, 166-176; “The Living Weapon”; Guillemin, *Biological Weapons*, 105-106; Moon, “Weapons Program,” 25-26. For clinical symptoms of Q fever, see Center for Disease Control, “Q Fever” (7 October 2006) <http://www.cdc.gov/ncidod/dvrd/qfever/> (accessed 28 January 2007); Center for Food and Public Health Safety, “Q Fever,” 1-2, [http://www.cfsph.iastate.edu/Factsheets/pdfs/q\\_fever.pdf](http://www.cfsph.iastate.edu/Factsheets/pdfs/q_fever.pdf) (accessed 23 April 2007).

the area to become ill.”<sup>31</sup> Subsequent tests in the South Pacific during the 1960s under Project 112, effectively demonstrated that “biological warfare could rival nuclear warfare” in producing mass casualties.<sup>32</sup>

One reason historians have not focused more on the environmental impact of BW testing at Dugway and other sites is that the military steadfastly maintained that “in the 40-year history of the U.S. Army’s biological warfare/defense program conducted at Fort Detrick and Dugway Proving Ground, not a single incidence of human or animal disease associated with the testing program has occurred in the surrounding communities.”<sup>33</sup> At Dugway, Army BW researchers argued that there had “been no ecological changes and no increase in the reservoir of endemic diseases, in the several thousand square mile area covered by the continuing [ecological] surveys” to the best of their knowledge.<sup>34</sup> They based this claim on the relatively strict safety protocols for testing. No pathogen could be tested that was not already endemic to the West Desert nor were any pathogens allowed that used insect vectors to disseminate disease.<sup>35</sup>

To ensure the safety of BW tests, the Army contracted an independent party to monitor the possible occurrence of commonly tested pathogens in wildlife populations within DPG and the surrounding environs. From 1952 to 1969, ecologists from the

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<sup>31</sup> U.S. Army Chemical Corps, “Summary of Major Events and Problems for the Fiscal Year 1959,” (Aberdeen, MD: US Army Chemical Corps Historical Office, Army Chemical Center, 1960), 107-108, <http://www.osti.gov/opennet/servlets/purl/16006843-5BAfk6/16006843.pdf> (accessed on 25 April 2007).

<sup>32</sup> Guillemin, *Biological Weapons*, 111; Regis, *The Biology of Doom*, 221-222; House Report, *Environmental Dangers*, 47. The Desert Test Center at Fort Douglas directed BW testing operations at sites ranging from Greeley, Alaska to the Marshall Islands under Project 112. For further details, see Regis, *The Biology of Doom*, 188, 199-200, 202, 204, 233.

<sup>33</sup> For quote, see Dynamic Corporation, “Supplement to the Draft Environmental Impact Statement: Biological Aerosol Test Facility. New Alternative Action to Construct and Operate a Consolidated Life Science Test Facility at Dugway Proving Ground, Utah,” (Dugway, UT: U.S. Army Dugway Proving Ground, 1990), C-13. For further details, see Chip Ward, *Canaries on the Rim*, 105-110; Cole, *Clouds of Secrecy*, 7, 136-175; House Hearings, *Environmental Dangers*, 43, 111.

<sup>34</sup> House Hearings, *Environmental Dangers*, 43.

<sup>35</sup> Parsons Engineering Science Inc., “Dugway Proving Ground,” 2-17. Apparently arachnids like ticks, which were vectors for tularemia, plague, Q fever, and other pathogens employed by the Army, were not considered insects under these protocols.

University of Utah (UofU) acted as the Army's official oversight group. Their studies on the ecology and epizootics of the West Desert were comprehensive and meticulous. They performed detailed surveys of all extant fauna and conducted extensive studies on the nature of disease transmission in Great Basin ecological systems.<sup>36</sup> After nearly twenty years of research and monitoring of disease, these civilian scientists also concluded that BW testing created no adverse impact on the ecology of the West Desert.<sup>37</sup>

Evidence suggests, however, that UofU ecologists did not provide effective oversight, non-endemic diseases that used insect vectors were introduced into the region, and the range of endemic diseases may have increased due to BW testing. The UofU researchers began their surveys in 1952, a year after the resumption of BW testing at DPG. Thus there was no pre-testing baseline, nor records to establish which pathogens were endemic or the rates of endemic diseases, until at least 1954.<sup>38</sup> By this time nearly twenty-five BW trials, employing pathogens that cause anthrax, plague, brucellosis, Q fever, and tularemia had been conducted at DPG.<sup>39</sup> The UofU ecologist also did not possess clear knowledge of when, where, or how these top secret BW tests were conducted. Such limitations constrained the oversight group's ability to monitor the effects of BW testing on local ecology.

Critics of the Army BW testing program have also suggested that the "Army's economic contribution to Utah" deterred the UofU ecologists from functioning "as an

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<sup>36</sup> See University of Utah's Ecological and Epizootological Research Group's Annually Summary Reports for the years 1953 to 1969, Harold B. Lee Library, Brigham Young University, Provo; House Hearings, *Environmental Dangers*, 43.

<sup>37</sup> Van Atta, "Germ Agents Tested in Utah for 25 Years."

<sup>38</sup> Even by this time they had still not found evidence of diseases that were thought to commonly occur in the region such as tularemia. For further details, see UofU Ecological Research Group, "Symposium on Ecology of Disease Transmission in Native Animals," (Dugway Proving Ground, 6, 7, 8 April 1955), 5, 98-100, 102.

<sup>39</sup> Guillemin, *Biological Weapons*, 103-104; "Weapons Testing Documents."

independent agent.”<sup>40</sup> This thesis stems largely from the obstinate manner in which UofU ecologists defended their controversial findings of Venezuelan equine encephalitis (VEE) infection--an insect-borne disease thought to prevail only in tropical areas--in rodents, birds, and other wildlife in the West Desert.<sup>41</sup> Many critics believed that the disease’s presence could only be explained by Army testing.<sup>42</sup> The UofU ecologists admitted that “Dugway probably tested Venezuelan equine encephalitis, a highly infectious viral disease,” but claimed “the migratory birds that fly past Dugway did not contract it from the base.” They reasoned that VEE was endemic to the region, but this had not been scientifically established because “no one else has looked for it in other states where there are flyways... so naturally they haven’t found it.”<sup>43</sup> These arguments were unsatisfactory to critics because they inexplicably excluded the possibility that the infection was introduced by open-air or laboratory testing of VEE.<sup>44</sup> The dispute remains unsettled, but a 1994 U.S. Congressional investigation reported that prior “to the identification of these substances in the Dugway vicinity ... VEE had been used in the open-air tests at Dugway or within laboratories, and transferred to the nearby animal population.”<sup>45</sup> This and other criticisms suggest not only that the Army’s safety protocols did not always work but that oversight measures were insufficient. The lack of an accurate baseline and other possible self-interests had skewed the oversight of the Army’s testing program.<sup>46</sup>

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<sup>40</sup> House Report, *Environmental Dangers*, 177-178 (quotation), 54-55, 89, 129, 177, 184-185.

<sup>41</sup> Robert R. Sidwell, Louis P. Gebhardt, and Bert D. Thorpe, “Epidemiological Aspects of Venezuelan Equine Encephalitis Virus Infections,” *Bacteriological Review* 31 (March 1967): 71.

<sup>42</sup> House Hearings, *Environmental Dangers*, 54-55, 89, 177-178, 184-185.

<sup>43</sup> Van Atta, “Germ Agents Tested in Utah for 25 Years.”

<sup>44</sup> House Report, *Environmental Dangers*, 177.

<sup>45</sup> Senate Committee on Veteran’s Affairs, *Is Military Research Hazardous to Veteran’s Health? Lessons Spanning Half a Century*, 8 December 1994, 103<sup>rd</sup> Cong., 22<sup>nd</sup> Sess., 8 December 1994, <http://www.gulfweb.org/bigdoc/rockrep.cfm> (accessed 24 April 2007).

<sup>46</sup> For further evidence on the use of insect vectors at Dugway, see Ward, *Canaries on the Rim*, 98; U.S. Army, “Outdoor Mosquito Biting Activities: Project Bellwether, BW 459 (U),” (1960), *Public STINET*, <http://stinet.dtic.mil/index.html> (accessed 24 April 2007).

The debate surrounding the issue of introducing non-endemic, insect-borne pathogens into the West Desert by BW testing was contentious, but it completely ignored the question of how the open-air testing of any pathogen, regardless of its origin or mode of transmission, can adversely affect the local disease ecology. Plague and anthrax were the most hazardous diseases tested at Dugway, but the spread of Q fever, ostensibly a less threatening agent, provides the best evidence that the testing of endemic diseases may have adversely affected the environment. Beginning in 1958, a marked increase in the incidence of Q fever infections, which is primarily an air-borne disease, occurred in wildlife populations throughout the West Desert. Rates of infection peaked in 1960 and returned to relatively low levels by 1963.<sup>47</sup> Affected wildlife included rabbits, twelve types of rodents, mule deer, and various ectoparasites.<sup>48</sup> Cattle, sheep, and goats were the primary reservoirs of Q fever, yet UofU researchers did only limited testing of local livestock during the epizootic.<sup>49</sup> Tests in 1956 found that Q fever was uncommon among sheep but occurred in cattle.<sup>50</sup> Indicative of the limitations of the UofU's oversight measures, 1956 was the first year of testing local livestock and wildlife even though the

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<sup>47</sup> Serological Q fever reactions above 1:16 titers indicated evidence of recent infection. Signs of Q fever in West Desert wildlife rose from 4.7 percent in 1958 to 7.4 percent in 1959 and to 23.5 percent in 1960 and then declined to 14.4 percent in 1961 and 8.9 percent in 1962. For further details, see Ecological and Epizootological Research Group, "A Study on the Ecology and Epizootology of the Native Fauna of the Great Salt Lake Desert: Annual Report" (1 Jan 1962 to 31 March 1963), 60-78; Keith L. Smart, *Ecology Studies of the Bonneville Basin of West Central Utah*, (Dugway, UT: U. S. Army, Dugway Proving Ground, 1976), 63.

<sup>48</sup> The majority of infections were found in rabbits and rodents. Of 378 black-tailed jackrabbits (*Lepus californicus*) surveyed in 1960, 154 or 40.7 percent showed signs of recent infection. Similar amounts of rodent species were tested and also displayed high incidences of infection. For example, 25.3 percent of deer mice (*Peromyscus maniculatus*), 28.2 percent of desert woodrats (*Neotoma lepida*), 37.3 of percent Chisel-Toothed Kangaroo Rats (*D. microps*), and 29.2 percent of canyon mice, (*Peromyscus crinitus*) tested displayed signs of infection. For further details, see Epizootological Research Group, "Annual Report," (1 Jan 1962 to 31 March 1963), 66-68; Smart, *Ecology Studies*, 63.

<sup>49</sup> For livestock as primary reservoir, see Center for Disease Control, "Q Fever"; Center for Food and Public Health Safety, "Q Fever," I; For livestock testing, see Epizootological Research Group, "Annual Report," (1 Jan 1962 to 31 March 1963), 77.

<sup>50</sup> Manuel S. Barbeito and Richard H. Kruse, "A History of the American Biological Safety Association Part I: The First 10 Biological Safety Conferences 1955-1965," *American Biological Safety Association*, <http://www.absa.org/abohist1.html> (accessed 21 May 2007).

Army had been experimenting with Q fever for five years.<sup>51</sup> Thus, like with many other pathogens tested by the military, no effective baseline had been established prior to the advent of military testing. At a basic level, it was impossible to judge what role BW tests may have played in the epizootic.<sup>52</sup>

Nevertheless, the evidence that does exist suggests an insidious legacy for BW testing. Tests employing Q fever in the years prior to the outbreak generated enormous aerosolized clouds that spread across large tracts of land. Contaminated clouds generated during the 1955 test on Seventh Day Adventist soldiers, for example, were suspected to have drifted over thirty-five miles of land. On Highway 40 motorists were ordered to roll up their windows on the day of the test.<sup>53</sup> In cases such as the massive 1958 aerial spray test, the cloud of Q fever was generated from over forty gallons of slurry, one drop of which could contain billions of individual pathogenic organisms.<sup>54</sup> These organisms, moreover, were highly persistent and could live “for up to 30 days in dried sputum, 120 days in dust, 49 days in dried urine from infected guinea pigs, and for at least 19 months in tick feces. At 4–6°C, organisms can survive for 42 months in milk and 12 to 16 months in wool.”<sup>55</sup>

This evidence suggests that the open-air testing of Q fever had a high probability of collateral harm, yet military scientists insisted that the origin of the local epizootic came from a different undocumented source. In 1976, Keith L. Smart, chief of the ecology and environmental branch at Dugway, reexamined the UofU’s research on the 1960 epizootic. He found that while the 1960 epizootic was widely dispersed throughout

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<sup>51</sup> Smart, *Ecology Studies*, 63; Army, “Installation Assessment,” 25; “Weapons Testing Documents.”

<sup>52</sup> Smart, *Ecology Studies*, 63.

<sup>53</sup> Regis, *Biology of Doom*, 176.

<sup>54</sup> U.S. Army, “Summary of Major Events and Problems for the Fiscal Year 1959,” 107-108; Chip Ward, *Canaries on the Rim*, 106; Piller, *Gene Wars*, 141.

<sup>55</sup> The Center for Food and Public Health Safety, “Q Fever.”

the West Desert, certain areas had particularly high incidences of infection. Traps near the Deep Creek Mountains, the town of Callao, Utah, Fish Springs, the Dugway Mountains, the Old River Bed, Government Creek, South Cedar Mountain, Lookout Pass, and the town of Vernon all yielded high rates of seropositive animals.<sup>56</sup> These areas of high incidence of infection tended to be adjacent to each other along an east-to-west corridor directly south of the proving ground, the same corridor that the Bennion brothers, Sydney Nicholes, and other herders had used for nearly a hundred years. Based on these findings, Smart hypothesized that “the initial sources of natural [Q fever] infection may have occurred through the sheep-herd-carrier mechanism, with the possibility of intensive shedding of the *C. burnetti* organisms into the soil as infective placentae [sic] at lambing time.”<sup>57</sup> In one of those classically pathological moments that military officials seem to succumb to a regular basis, Smart concluded that there was thus “nothing to indicate an adverse causative impact” on the Q fever epizootic from BW testing activity at Dugway.<sup>58</sup>

The complicated history of disease in the West Desert lends itself to such exculpatory science. Humans have shaped the disease ecology of the West Desert for thousands of years. The livestock brought to the West Desert likely transformed the disease ecology of the West Desert long before the twentieth century. They were the primary reservoirs of not only Q fever but brucellosis. These were, however, also the two most frequently tested pathogens at Dugway during the 1950s.<sup>59</sup> Sheep, cattle, and planes

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<sup>56</sup> Epizootological Research Group, “Annual Report,” (1 Jan 1962 to 31 March 1963), 72-73; Smart, *Ecology Studies*, 62.

<sup>57</sup> Smart, *Ecology Studies*, 62.

<sup>58</sup> Smart, *Ecology Studies*, 10. Smart neglected the areas of high incidence within Dugway Proving Ground which roughly matched the rates found south of the proving ground. Smart also had no evidence that sheep were affected by the 1960 epizootic.

<sup>59</sup> Scientific Committee on Animal and Human Welfare, “Brucellosis in Sheep and Goats (*Brucellosis melitensis*)” (12 July 2001), 7-10, [http://ec.europa.eu/food/fs/sc/scsh/out59\\_en.pdf](http://ec.europa.eu/food/fs/sc/scsh/out59_en.pdf) (accessed 28 January 2007); Center for Disease

all spread these and other pathogens to the West Desert. Their ecological impact is difficult, if not, impossible to ascertain. What can be said is that by the time the military began testing BW, the disease ecology of the West Desert was already an amalgamation of pathogenic organisms that had been shaped by both natural and cultural forces. The ecology simply grew much more muddled during the Cold War. Determining causal relationships within such a complicated hybrid ecological system is thus exceedingly difficult, especially without suitable baseline data.<sup>60</sup> The quality that made BW so attractive to military scientists—their ability to mimic “naturally occurring outbreaks”—also made the effects of BW difficult to trace.<sup>61</sup> Smart’s conclusions offered no evidence beyond correlation, but the same was true of the evidence and correlations implicating the Army’s BW testing program in local disease epizootics. The argument was and remains irresolvable.

At the same time, few people, besides military officials, have argued that the BW testing at Dugway was not potentially dangerous. “There is no such thing as a microorganism that cannot cause trouble,” notes George H. Connell, the former assistant director of the Center of Disease Control and Prevention. “If you get the right concentration at the right place, at the right time, and in the right person, something is going to happen.”<sup>62</sup> Prominent biochemist and arms control specialist Matthew S. Meselson similarly observes that “the field testing of biological weapons, especially

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Control, “Q Fever.” For Q fever and Brucellosis as most frequently tested agent in the 1950, see Army, “Installation Assessment,” 23-27; “Weapons Testing Documents”; Davidson “At a Glance”; Parsons Engineering Science Inc., “Dugway Proving Ground,” 2-18, 2-19, 2-20.

<sup>60</sup> For a further discussion on the difficulties of distinguishing between BW attacks and natural outbreaks and how recent advances have made it easier, see Mark Wheelis, “Investigation of Suspicious Outbreaks of Disease,” in *Biological Warfare: Modern Offense and Defense*, ed. Raymond A. Zilinskas (Boulder: Lynne Rienner Publishers, inc., 2000), 105-117.

<sup>61</sup> Guillemin, *Biological Weapons*, 93.

<sup>62</sup> Senate Subcommittee on Health and Scientific Research and the Committee on Human Resources, *Biological Testing Involving Human Subjects by the Department of Defense*, 8 March and 23 May 1977, 95<sup>th</sup> Cong., 1<sup>st</sup> Sess., (Washington, D.C.: Government Printing Office, 1977), 18-19; Cole, *Clouds of Secrecy*, 54.

viruses, could lead to the infection of rodents or bird populations and lead to emergence of a hitherto unknown and dangerous organism.”<sup>63</sup> These were the potential risks, but risks were not the same as documented evidence that Dugway testing adversely affected the environment.<sup>64</sup> Bodies were indeed constantly moving in, out, and around the proving ground, so there was some undefined probability that some insects, animals, and humans did come into contact with pathogens originally spread from bombs, airplanes, or generators. It is simply impossible to link these actuarial certainties with hard evidence. The consequences of these encounters may have been benign, and, as military scientists have suggested, pathogens such as Q fever may have died out or returned to regulated levels. Conversely, because these agents were alive and able to reproduce, the potential adverse consequences of BW testing were theoretically equally possible.<sup>65</sup> We just do not know.

These incalculable risks shaped the way people perceived the West Desert. When fifty wild horses suddenly dropped dead in 1976 at a spring located roughly fifteen miles from Dugway’s entrance, many civilians wondered if VEE or other biological agents were responsible. After an exhaustive investigation, military researchers concluded that the wild horses died from dehydration. This explanation failed to persuade, however, because the horses died within a few yards of a spring. Many still believe the deaths resulted from biological agents and that Army officials lied.<sup>66</sup> Such fears about the

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<sup>63</sup> Seymour Hersh, “Dare We Develop Biological Weapons?,” *New York Times Magazine*, 28 September 1969 quoted in Michael McClintock et al, eds., *Environmental Effects of Weapons Technology* (New York: Scientists’ Institute for Public Information, 1970), 16. For a further discussion on the history of biological safety, see Barbeito, “Biological Safety Conferences 1955-1965.”

<sup>64</sup> For modern safety standards and risk assessment, see Barbara Johnson, “Understanding, Assessing, and Communicating Topics Related to Risk in Biomedical Research Facilities,” *American Biological Safety Association*, <http://www.absa.org/0100johnson.html> (accessed 24 May 2007).

<sup>65</sup> House Report, *Environmental Dangers*, 54.

<sup>66</sup> Lee Davidson, “Mysterious Deaths: Ex-soldier Links Horses’ Malady in 1976 to his Poor Health,” *Desert News*, 28 August 2005, <http://deseretnews.com/dn/view/0,1249,600158926,00.html>; Army Dugway Proving Ground Utah,

dangers of the West Desert have become a part of the complex and unsettling cultural legacy of BW testing and they were reinforced by the repetitions of these poorly explained die-offs over time.

### **Radiological and Chemical Testing at Dugway, 1951-1969**

Part of the mistrust concerning Dugway officials' conclusions regarding the wild horse deaths stems from how officials handled the deaths of sheep in March of 1968. To fully comprehend the Skull Valley sheep kill, it is necessary to understand not only the shortcomings in Army safety protocols and oversight measures governing Dugway's testing program, but also how accidents and malfunctions occurred repeatedly, weather conditions were at times disregarded, tests were sometimes conducted in a cavalier manner, and CBR warfare material often missed the test grid. The history of radiological and chemical weapons best demonstrates these operational shortcomings.

Nuclear R&D at Dugway was modest compared to programs at other sites such as Los Alamos and the Nevada Test Site, but DPG's contribution was significant. Dugway was one of four sites that the Atomic Energy Commission (AEC) considered for a continental nuclear testing site.<sup>67</sup> Nuclear bombs were never tested there, but it did host at least seventy-four radiological weapons tests and eight small nuclear meltdowns.<sup>68</sup> The largest amount of radioactive contamination came from the radiological weapons tests conducted between 1949 and 1953. These were performed on four target grids

"Investigation of Deaths of Horses at Orr Springs," (1976), *Public STINET*, <http://stinet.dtic.mil/index.html> (accessed 24 April 2007).

<sup>67</sup> The four sites considered were the current Nevada Test Site, Dugway, Alamogordo, and Camp Lejeune off the coast of North Carolina. The Nevada Site was chosen primarily because there were considered to be too many people downwind from Dugway. For further details, see Atomic Energy Commission, "Location of Proving Ground for Atomic Weapons," in House Committee on Interstate and Foreign Commerce and Senate Committee on Labor and Human Resources, *Health Effects of Low-Level Radiation*, 96<sup>th</sup> Cong., 1<sup>st</sup> Sess., 19 April 1979, No. 96-41, (Washington D.C., Government Printing Office, 1979), 1410-1424.

<sup>68</sup> Lee Davidson, "Did the Army Conduct over 600 Radiation Tests?: Officials Remain Taciturn, but Newly Released Papers Reveal Massive Project." *Deseret News*, 10 April 1994.

surrounding the southern end of Granite Peak, using Tantalum-182 (Ta-182). Among common radioactive materials, only plutonium was considered more dangerous at the time. Acceptable exposure rates for Ta-182 were set at seven thousandths of a curie, yet the seventy-four tests released an estimated 153,000 curies of Ta-182 into the environment.<sup>69</sup>

Much of this material went “unaccounted for.” There were no tests in which all of the radioactive material was recorded, and around 60 to 70 percent of the radioactive bomb filling was simply lost in most of the seventy-four tests.<sup>70</sup> Nearly all reports offered the same blanket explanation to account for the missing material: a negligible quantity left the target in the burst cloud, some of it clumped together to form hot spots, and some material was buried below the surface of the grid.<sup>71</sup> Little documentation accompanied this boilerplate conclusion.

Everything about these tests was mutable. Safety standards were not only low but adjustable. Investigative journalist Lee Davidson found that one safety report remarked that “meteorological requirements for carrying out the tests could be reduced considerably, if necessary, in order to get the tests off on time.”<sup>72</sup> This cavalier attitude likely enabled the AEC to conduct eight nuclear meltdowns, which in total released an estimated 215.67 curies of radiation across 250 square miles of land at Dugway in 1959.<sup>73</sup>

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<sup>69</sup> Army Chemical Center, “Static Test of Sectional Munitions,” (Dugway, UT: Dugway Proving Ground, [1953]), Western Americana, J. Willard Marriot Library, University of Utah, Salt Lake City; Lee Davidson, “600 Radiation Tests”; Lee Davidson, “Cold War Weapons Testing”; Bauman, “Military Testing.”

<sup>70</sup> Army, “Static Test of Sectional Munitions.”

<sup>71</sup> Army “Static Test of Sectional Munitions.” This explanation was apparently suitable for test result standards at the time, because no adjustments were made to testing procedures even though the level of radioactive material used in the tests gradually increased. For details on the increasing scale of tests, see Davidson, “600 Radiation Tests.”

<sup>72</sup> Davidson, “600 Radiation Tests”; Army, “Static Test of Sectional Munitions.”

<sup>73</sup> These meltdowns were done to assess the potential hazards of a reactor meltdown occurring in a hypothetical nuclear-powered aircraft. For further details, see Air Force Special Weapons Center-Air Research and Development Command, “Fission Products Field Release Test II,” (Kirtland Air Force Base, NM: Air Force Special Weapons Center-Air Research and Development Command, [1960]), Western Americana, J. Willard Marriot Library, University of Utah, Salt Lake City.

The AEC chose Dugway because they believed it provided enough space to conduct meltdowns “under strong meteorological inversion conditions,” thus allowing them to establish “the upper limit of the possible hazards of a nuclear accident of the meltdown type.”<sup>74</sup> There were also occasional accidents. On 6 August 1950, the bombing crew of field test 288 was supposed to drop a cluster bomb activated at 480 curies over target J, “but due to the mistake in identification of the target... the bomb impacted on Target K” two miles to the north.<sup>75</sup> The bomb also malfunctioned, not activating until contact, which created a fifty-foot wide crater and “dispersed significant contamination” that “could be detected as far as 4000 yd to the NNW of the crater.”<sup>76</sup>

Mutability worked both ways, however. The element TA-182 fits in no single category except “lethal,” yet it possessed a half-life of only 115 days, which mitigated its long-term impact. The chemical agents commonly employed in CW tests at DPG from the early 1951 to 1969 were similarly unstable. In 1945, British troops discovered artillery containing a potent and dangerous organophosphate chemical compound at a German munitions depot. The discovery gave the Chemical Corps a new, postwar mission focusing on the R&D of organophosphate nerve agents. The first agents synthesized and standardized were sarin (GB) and tabum (GA). By the mid 1950s, a new more lethal and persistent nerve agent called VX was developed and standardized. From 1951 to 1968, the Army conducted at least 1,200 separate open-air tests employing VX, sarin, and tabum at Dugway.<sup>77</sup> An estimated 47,900 chemical rockets, artillery shells,

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<sup>74</sup> Air Force, “Fission Products,” 1, 17. The radiation fallout from these test were suspected to have traveled to Highway 40 and possibly affected the town of Knolls.

<sup>75</sup> Army, “Static Test of Sectional Munitions.”

<sup>76</sup> Army, “Static Test of Sectional Munitions.”

<sup>77</sup> Records also indicate that mustard agent was tested at Dugway from 1951 to 1956. For these figures and for figures on nerve agent testing, see U.S. Army Dugway Proving Ground, “Installation Action Plan for U.S. Army Dugway Proving Ground, Dugway, Utah,” (Dugway, UT: Dugway Proving Ground, 2000), 5; Lee Davidson, “Lethal

bombs and land mines filled with these nerve agents were expended.<sup>78</sup> These munitions, along with the agent employed in 111 aerial spray tests, released approximately 494,700 pounds of nerve agent into the open air.<sup>79</sup>

The safety protocols for this prolific CW testing were established by a committee of military and civilian scientists in the early 1950s and were periodically reviewed by the Department of Defense.<sup>80</sup> Unlike with BW testing, however, there was no independent oversight of the environmental impact of CW.<sup>81</sup> When VX was first approved for testing in 1957, newly-established safety protocols proscribed all aerial testing of the agent and recommend that only artillery munitions filled with VX be tested at DPG. The restrictions were eased after Army researchers had gained experience with the agent--again, with no independent verification of their findings--and by 1962 Dugway officials began large-scale aerial sprays of VX.<sup>82</sup>

The nature of CW field testing also differed from the tests conducted during WWII. The simulated targets during the war were replaced by massive test grids that contained sampling arrays to measure the dissemination and behavior of chemicals at various horizontal and vertical sites.<sup>83</sup> As with BW testing, the primary goal of CW

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Breeze," *Deseret News*, 5 June 1994; Lee Davidson, "At a Glance: Weapons Testing Trends and Totals," *Deseret News*, 22 December 1994.

<sup>78</sup> Dugway, "Installation Action Plan," 5; Davidson, "Lethal Breeze,"; Lee Davidson, "At a Glance: Weapons Testing Trends and Totals," *Deseret News*, 22 December 1994.

<sup>79</sup> This total does not include the nerve agent expended in weekly demonstration for a CBR weapons orientation course that was conducted at Dugway from September 1959 to June 1969. Also documents show fifty-two open-air trials using 93,500 pounds of simulant conducted from 1951 to 1969. For further details, see Davidson, "Lethal Breeze." For figures on aerial spray tests, see Mauroni, *Chemical-Biological Warfare*, 34.

<sup>80</sup> House Hearings, *Environmental Dangers*, 110-113.

<sup>81</sup> Army, "Ad Hoc Committee," 20-23.

<sup>82</sup> House Hearings, *Environmental Dangers*, 110.

<sup>83</sup> Test grids ranged from 1,800 square feet to 150 square miles. For further details, see Tucker, *War of Nerves*, 204; Dugway, "Final Environmental Impact Statement," 1-16.

testing was to increase the range of dispersal.<sup>84</sup> The most effective devices were aerial sprays from high-speed jets. Even the earliest aerial spray tests were conducted in a highly dramatic and heedless fashion. Between 1951 and 1954, for example, at least twenty-seven aerial spray tests dispensed sarin or tabun from high-speed aircrafts. F-80 or F-47M fighters flew over test grids at speeds ranging between 300 to 400 miles an hour and at altitudes generally at or below one hundred feet.<sup>85</sup> Records of the first series of VX aerial spray tests in 1962 suggest that munitions tests actually did not teach researchers much about how to control the dispersion of VX. On 18 April 1962, for example, an aircraft carrying 203 pounds of VX dropped a “major portion” of the agent “before the aircraft was over the sampling grid.”<sup>86</sup> Other documents indicate that sometimes only a small portion of the VX agent hit the grid. In August 1962, an aircraft dropped 2,800 pounds of VX solution, but only 11 percent made it to the grid. An identical test a month later produced only a 4 percent recovery rate.<sup>87</sup> Author and activist Chip Ward notes that no one “knew where all that nerve gas went that missed the grid, but then no one was looking for it either.”<sup>88</sup>

These cases likely represent the low end of success rates for CW tests. While “recovery rates” of 10 to 30 percent were common, there were times when sampling arrays recorded 100 percent of the agent.<sup>89</sup> Still, successful test results did not equate with safe tests. VX was extraordinarily lethal. One small drop of the agent, weighing three to

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<sup>84</sup> CW tests in the 1950 and 1960s employed artillery, mortars, cluster bombs, massive bombs, drone rockets, land mines, and aerial sprays to disperse chemical agents or simulants, see Dugway, “Final Environmental Impact Statement,” 1-16.

<sup>85</sup> Davidson, “At a Glance”; Davidson, “Lethal Breeze.”

<sup>86</sup> Davidson, “At a Glance”; Davidson, “Lethal Breeze.”

<sup>87</sup> Davidson, “Lethal Breeze”; Davidson, “At a Glance.”

<sup>88</sup> Chip Ward, *Canaries on the Rim*, 102.

<sup>89</sup> Ward, *Canaries on the Rim*, 102; Davidson, “Lethal Breeze.”

four milligrams, could be lethal in less than fifteen minutes.<sup>90</sup> Preventing accidental exposures was challenging, yet the Army believed their record at Dugway was exemplary, at least for human exposures.<sup>91</sup>

Dugway officials were more reserved about the possible effects of nerve agents on the environment. This was partly because of the Army's limited understanding about their environmental impact, but subsequent studies suggest an unsettling ecological legacy.<sup>92</sup> Chemist and arms control specialist Julian P. Robinson noted that "if nerve gases were used at lethal levels to human beings... they would probably destroy a high proportion of whatever nonhuman vertebrate population was thereby also exposed, and many of the invertebrates as well, particularly arthropods." Nerve agents also exhibited herbicidal properties, but their impact on vegetation was probably slight.<sup>93</sup> Unlike with DDT and other chlorinated hydrocarbons, nerve agents decomposed relatively rapidly. Sarin's primary lethal properties tended to break down within ten minutes of dispersal, whereas VX, depending on weather conditions, could remain stable for up to three weeks and its lethal properties could persist for up to five months.<sup>94</sup> So far as is known, the byproducts of decomposed nerve agents such as alkylphosphonates tend to persist but do not present carcinogenic or other toxic hazards to living organisms.<sup>95</sup> There was also substantial variation in species sensitivity to nerve agents. Sheep, unlike cattle, horses, and humans, possess no natural buffer enzyme to protect against organophosphates,

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<sup>90</sup> Davidson, "Lethal Breeze"; Nancy B. Munro, Kathleen R. Ambrose, and Annetta P. Watson, "Toxicity of the Organophosphate Chemical Warfare Agents GA, GB, and VX: Implications of Public Protection," *Environmental Health Perspectives* 102 (January 1994): 24-26; Tucker, *War of Nerves*, 158-159.

<sup>91</sup> For details on safety record, see Army, "Ad Hoc Committee," 10-11.

<sup>92</sup> Army, "Ad Hoc Committee," 12-33; Brodine, "Wind from Dugway," 216.

<sup>93</sup> J.P. Robinson, *The Effects of Weapons on Ecosystem* (Toronto: Pergamon Press, 1979), 19-20

<sup>94</sup> Munro, "Toxicity," 26; House Report, *Environmental Dangers*, 13

<sup>95</sup> Robinson, *The Effects of Weapons on Ecosystem*, 20; Munro, "Toxicity," 30-34.

making them extremely sensitive to the compound.<sup>96</sup> In short, the long-term effects of nerve agents dispensed in an open environment were highly unpredictable.<sup>97</sup>

### **The 1968 Skull Valley Sheep Deaths**

Even though the Army had extensive experience with CW, they still lacked critical knowledge about the nature of nerve agents. Before the March 1968 sheep kill incident, for example, the Army had no data on the effects of VX on sheep.<sup>98</sup> Even more portentous, the Army held erroneous assumptions about the movements of nerve agents through the air.<sup>99</sup> According to Tucker, the guiding principle underlying the safety of CW tests at Dugway prior to the sheep deaths was that “the vast majority of droplets in an agent plume would settle to the ground within a mile of the point of release, while the rest would be diluted to harmless levels by the time they reached the border of the proving ground.”<sup>100</sup>

These assumptions were simply wrong. A number of investigations after the sheep kill concluded that lethal amounts of VX agent from the March 13 aerial spray were carried up to forty-five miles past the Dugway test grid.<sup>101</sup> The studies noted that after the 5:30pm test of the newly-developed chemical spray tanks, which had inadvertently sprayed some twenty pounds of VX beyond the target area, a storm front “sucked up and retained the oily droplets.”<sup>102</sup> Easterly winds and scattered showers

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<sup>96</sup> Tucker, *War of Nerves*, 211; Army, “Ad Hoc Committee,” 21; House Hearings, *Environmental Dangers*, 136, 173.

<sup>97</sup> Pesticides were regularly employed near testing grids and other areas around Dugway. One of the few studies that have examined the reactivity of nerve agents found a fifty-fold increase in toxicity when nerve agents were mixed with common pesticides like EPN, O-Ethyl-O-(4-nitrophenyl) phenylphosphonothioate, and malathion. For further details see, Munro, “Toxicity,” 27; For further discussion on the issue of chemicals unpredictable fate in the environment, see House Hearings, *Environmental Dangers*, 36-45, 53-61, 6-77, 173-178, 229-231; Carson, *Silent Spring*, 38-39.

<sup>98</sup> House Hearings, *Environmental Dangers*, 111-112.

<sup>99</sup> Brodine, “Wind from Dugway,” 290.

<sup>100</sup> Tucker, *War of Nerves*, 204.

<sup>101</sup> The farthest affected sheep were forty-five miles away in Rush Valley, see Boffrey, “Nerve Gas,” 1461.

<sup>102</sup> Tucker, *War of Nerves*, 206.

“washed airborne VX out of the air and deposited it on vegetation and the ground” in Skull Valley.<sup>103</sup> Only trace amounts of the deadly agent were deposited, but this was more than enough to kill the hypersensitive sheep. After the incident, the Army tested the effects of similar trace amounts of VX on sheep. Initially, they reported that the test sheep did not display the same symptoms as the affected sheep. Later in congressional testimony, however, they admitted that the symptoms were “essentially the same.”<sup>104</sup>

These findings were only part of the considerable evidence linking nerve gas to the sheep deaths, yet Army officials consistently denied any involvement. During the first week after the sheep deaths, for example, Dugway officials claimed they had not conducted any tests in the last eight months and had done nothing to harm the animals.<sup>105</sup> The Army’s position was compromised a few days later when a classified Pentagon memo was leaked stating that Dugway conducted an aerial spray of 320 pounds of a persistent chemical agent on March 13.<sup>106</sup> Even after this disclosure, Dugway officials continued to maintain that, “as far as has been determined, we had nothing to do with it. We feel we are definitely not responsible.”<sup>107</sup> Nevertheless, the Army was further undermined the next month when the National Communicable Disease Center in Atlanta “proved beyond a doubt” that traces of a chemical found in the blood and rumen contents of the affected sheep, as well as in forage and snow collected in Skull Valley, were “identical in chemical composition to a sample of the test agent supplied by Dugway.”<sup>108</sup>

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<sup>103</sup> Boffrey, “Nerve Gas,” 1461.

<sup>104</sup> House Hearings, *Environmental Dangers*, 139.

<sup>105</sup> House Report, *Environmental Dangers*, 7-10

<sup>106</sup> Arthur R. Tilford, “An Analysis of the Public Relations Activities Utilized by the Department of Defense during the Dugway Sheep Incident of 1968,” (MA Thesis, Department of Communications, BYU, 1970), 39-41.

<sup>107</sup> House Report, *Environmental Dangers*, 8.

<sup>108</sup> House Report, *Environmental Dangers*, 247.

The Army never admitted guilt, but it did pay local ranchers \$376,685.<sup>109</sup> Also, for the first time the Army commissioned an independent advisory committee to review CW testing procedures at Dugway in fall 1968.<sup>110</sup> This ad hoc committee, headed by U.S. Surgeon General William H. Stewart, made a number of recommendations to the testing program, including reducing the scale of CW tests, proscribing tests when winds exceeded fifteen miles an hour or thunderstorms were “present within 100 miles of the test site,” and ensuring that the agent cloud could “not cross highway 40 until at least three hours” after dispersal.<sup>111</sup> The Army approved and implemented all the recommendations. In taking such measures, it hoped to conduct its testing program “in the safest manner possible” and put the sheep deaths behind them.<sup>112</sup> These hopes did not last long.

There was widespread concern about the Skull Valley sheep kill incident both nationally and internationally, yet within the Bonneville Basin the outcry was more muted.<sup>113</sup> Residents were concerned about the safety of testing, and ranchers worried about rumors that the Army planned to annex Skull Valley as a safety measure.<sup>114</sup> Yet many locals also feared that the sheep kill incident would force the Army to shut down operations. Historian Erick Sparke, for example, noted that when Utah’s jobs were

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<sup>109</sup> To this day the Army continues to insinuate that sheep operators were the real perpetrators, but they have never offered any persuasive evidence to prove this or any other alternative explanation. For examples of Army officials and defenders trying to make a case against VX being the cause of the sheep deaths, see C. Grant Ash, “History of Skull Valley Sheep Deaths in 1968,” Americana Collection, L. Tom Perry Special Collections Library, Harold B. Lee Library, Brigham Young University, Provo; Mauroni, *Chemical-Biological Warfare*, 29-43; House Report, *Environmental Dangers*, 7-9; House Hearings, *Environmental Dangers*, 9, 118-147. For figures on compensation to sheep operators, see House Report, *Environmental Dangers*, 28; Sparke, “Nerve Gas,” 90.

<sup>110</sup> This so-called “impudent” committee ended not being so impartial. For example, the U.S. Congress later found that a key member on the committee was also a chairman for DuPont and had previously been a former field commander at Dugway. For further details, see House Hearings, *Environmental Dangers*, 118-121.

<sup>111</sup> Army, “Ad Hoc Committee,” 34-37.

<sup>112</sup> House Hearings, *Environmental Dangers*, 113

<sup>113</sup> Tucker, *War of Nerves*, 212; Sparke, “Death of Sheep,” 88, 93; Mauroni, *Chemical-Biological Warfare*, 43; McClintock, *Environmental Effects of Weapons Technology*.

<sup>114</sup> House Hearings, *Environmental Dangers*, 24, 173; Fowler, “How the Sheep Died.”

implicated “people did not wish to probe too deeply or protest too loudly. Public misgivings in Utah were stifled beneath a soothing blanket of dollars.”<sup>115</sup>

Economic figures and local officials’ reactions give credence to Sparke’s observation. Of the fifty-five individuals living in Skull Valley at the time of the incident, twenty-two were employed at Dugway.<sup>116</sup> In total, the Army employed approximately 1,500 civilians in support of CBW testing operations in Utah with an annual payroll of \$13.6 million.<sup>117</sup> The total payroll of all defense industries in the state in 1969 was \$288 million, of which \$237 million went to civilians.<sup>118</sup> The defense industry had been the mainstay of the region’s economy since the early 1940s. Many local residents did not want to endanger this vital industry. The desire to protect the status quo led civic leaders to support Army operations at Dugway after the Skull Valley incident. The Tooele City’s Chamber of Commerce, for example, passed a resolution expressing confidence in testing activities at Dugway.<sup>119</sup> Utah Senator Frank E. Moss encouraged the Army to admit their guilt and pay damages, yet he was careful to note that

Dugway has been a welcome participant in the Utah economy for 26 years, and I look forward to that cooperation continuing. I have every confidence that they can correct the safety breach which resulted in this one situation, and that they can continue to operate safely in the future.<sup>120</sup>

This show of confidence was unique to the Bonneville Basin. Representatives outside of Utah, along with much of the general public, expressed considerable doubt about the

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<sup>115</sup> Sparke, “Death of Sheep,” 90-91. For further details on lack of outcry against sheep deaths in Utah, see Boffrey, “Nerve Gas,” 1464; House Hearings, *Environmental Dangers*, 24.

<sup>116</sup> House Hearings, *Environmental Dangers*, 223.

<sup>117</sup> House Hearings, *Environmental Dangers*, 34-35.

<sup>118</sup> House Hearings, *Environmental Dangers*, 35.

<sup>119</sup> Boffrey, “Nerve Gas,” 1464.

<sup>120</sup> House Hearings, *Environmental Dangers*, 226.

Army's testing program spurring a landmark Congressional investigation into the incident.<sup>121</sup>

The primary issue guiding the May 1969 investigation by the House Committee on Government Operations was whether it was "possible to both release lethal chemicals, germs, or viruses into the air and to assure the safety of people, domestic animals, and wildlife using the air."<sup>122</sup> Their findings were damning. The committee condemned the Army's response to the sheep deaths. They found that Dugway officials had impeded investigations and caused unnecessary sheep deaths by denying that CW tests had taken place, withholding data, not supplying VX samples to civilian investigators, and furnishing false and disingenuous information.<sup>123</sup> In a particularly trenchant note, the committee stated that the Army had unjustifiably been "enmeshed in [a] web of secrecy, lack of candor, deception, and disregard of the public interest in connection with the open-air tests it has heretofore conducted with lethal chemical warfare compounds."<sup>124</sup>

The committee also questioned the safety of weapons testing at Dugway. They found that unpredictable weather conditions, the risk from catastrophic accidents, and the "insidious danger of subjecting people, animals, and the environment to a continuous low-level pollution from the deadly chemicals" made DPG an unsafe place for CW tests.<sup>125</sup> In addition, the Army's CW tests "had not been surrounded with sufficient

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<sup>121</sup> Tucker, *War of Nerves*, 212; Sparke, "Death of Sheep," 88, 93; Mauroni, *Chemical-Biological Warfare*, 43. For a report on a number of contemporaneous critical investigations on the sheep kill incident and chemical warfare testing, see McClintock, *Environmental Effects of Weapons Technology*.

<sup>122</sup> House Hearings, *Environmental Dangers*, 2.

<sup>123</sup> House Hearings, *Environmental Dangers*, 7-13.

<sup>124</sup> House Hearings, *Environmental Dangers*, 27.

<sup>125</sup> House Hearings, *Environmental Dangers*, 14-31, 20 (quotation), 53.

safeguards to protect the public interest,” and the 1968 ad hoc advisory committee’s new safety recommendations had numerous shortcomings.<sup>126</sup>

These findings led the committee to conclude that even “with substantial reforms in internal administration and diligent correction of past errors it is unlikely that a self-monitored Army program will or can give sufficient weight to the need for preventing environmental risks.”<sup>127</sup> These conclusions were far reaching. The committee argued that “all large-scale tests of lethal chemical warfare compounds are so intolerably hazardous to our own citizens that they cannot be justified at this time by any rational contention that they are necessary for national security. Protection of our own people, after all, is the first essential of national security.”<sup>128</sup> The BW testing program also drew censure. It was considered as “dangerous to the United States and for that matter the world, as it is to a potential enemy.” Thus the committee recommended “applying the brakes” to the “headlong rush toward developing chemicals and biological killers should be a matter of greatest urgency.”<sup>129</sup>

These recommendations, which challenged the guiding ethos of the U.S. foreign policy, were remarkable. The congressional committee believed that domestic environmental threats overrode Cold War threats. The highly limited evidence regarding testing activities at Dugway was troubling in several respects, yet the full extent of the Army’s CBR testing program at Dugway was not revealed until decades later. Records indicate that the series of events surrounding the sheep kill were not unique. Accidents and malfunctions occurred repeatedly, and meteorologists eventually concluded that the

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<sup>126</sup> House Report, *Environmental Dangers*, 25 (quotation), 14.

<sup>127</sup> House Report, *Environmental Dangers*, 25.

<sup>128</sup> House Report, *Environmental Dangers*, 31.

<sup>129</sup> House Hearings, *Environmental Danger*, 5; House Report, *Environmental Dangers*, 53.

weather conditions on 13 March 1968 were typical of the West Desert.<sup>130</sup> These operational shortcomings suggested a pattern of negligence that gave further credence to the assertion that “a self-monitored” Army testing program could not have given “sufficient weight to the need for preventing environmental risks.”<sup>131</sup>

Just as the early shepherders were incapable adopting ecologically sustainable grazing strategies without federal enforcement, the Army’s ecologically dangerous testing operations also demanded federal intervention. President Richard M. Nixon responded by banning all use of biological weapons and open-air chemical weapons tests in November 1969.<sup>132</sup> Over the next few years the U.S.’s CBW research program was “whittled down to little more than token efforts.”<sup>133</sup> Dugway’s operating budget shrank 60 percent, and civilian employment dropped by one third in the early 1970s.<sup>134</sup> Dugway gradually shifted from an aggressive offensive weapons testing program to restricted defensive research that relied on simulants and laboratory studies.<sup>135</sup> The Army and Dugway officials petitioned for continued CBW research funding, usually emphasizing how their program was the “best immediate guarantee” against a Soviet CBW attack.<sup>136</sup> Instead, in 1972 Nixon ratified the 1925 Geneva Protocol banning the use of chemical and biological weapons, and President Ford signed it into law in 1975. During that same

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<sup>130</sup> House Report, *Environmental Dangers*, 18.

<sup>131</sup> House Report, *Environmental Dangers*, 25. For further discussions on the U.S. Military’s lack of accountability regarding environmentally hazardous practices, see Tucker, *War of Nerves*, 213; Dalton, *Critical Masses*; Shulman, *The Threat at Home*.

<sup>132</sup> Sparke, “Nerve Gas,” 89, 93; Tucker, *War of Nerves*, 216-217; Mauroni, *Chemical-Biological Warfare*, 50-51; House Report, *Environmental Dangers*, 29-32.

<sup>133</sup> Ash, “Sheep Deaths,” 55.

<sup>134</sup> Ison, “Controversy at Dugway”; “Workers Await Word on Dugway Demise” *Deseret News*, Dugway Newspaper Clippings; “Panel Urges Closing of Dugway Base,” *Deseret News*, 16 August 1974, Dugway Newspaper Clippings; Brent Harker, “Scientist at Dugway Like it There,” *Deseret News*, 14 October 1974, Dugway Newspaper Clippings; Robert Woody, “Dugway Quietly Moves into New Study Area,” *The Salt Lake Tribune*, 9 February 1975, Dugway Newspaper Clippings.

<sup>135</sup> “Panel Urges Closing of Dugway Base”; Harker, “Scientist at Dugway Like it There”; Woody, “Dugway Quietly.”

<sup>136</sup> House Hearings, *Environmental Dangers*, 220; Tucker, *War of Nerves*, 212-213; Harker, “Scientist at Dugway Like it There”; “Workers Await Word on Dugway Demise.”

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period, civilian employment at Dugway dropped another third and, more significantly, the Army Material Acquisition Commission found Dugway superfluous and recommended its closure.<sup>137</sup>

While this was largely a story of excess and censure, it also revealed the ongoing tensions between the pastoral and national security landscapes. The area in which two shepherders had first discovered their sheep falling dead was only ten miles from English Village, where more than 2,000 people lived and worked behind security fences at Dugway. The area east of the Cedar Mountain held valuable grazing land, but it was also a buffer area for the CBR tests on the other side of the mountain. The result was the production of a space of social, cultural, political, economic, and ultimately ecological contestation. National security concerns enabled the Army to annex grazing lands and displace sheep operations in the 1950s. By the late 1960s, though, national security had been redefined as a result of the emerging environmental movement. Domestic threats to nature became paramount. Chemicals were recast as particularly insidious threats.<sup>138</sup> Instead of annexing Skull Valley in the name of national security after the sheep kill incident, the Army was forced to fight for the survival of Dugway.

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<sup>137</sup> Brain Nutting, "Dugway Sets its Sights on New Horizons," *The Salt Lake Tribune*, 15 August 1975, Dugway Newspaper Clippings; "Panel Urges Closing of Dugway Base"; Harker, "Scientist at Dugway Like it There"; "Workers Await Word on Dugway Demise."

<sup>138</sup> For further details on the rise on the modern environmental movement as a response to the ecological threat of manufactured chemicals, see Carson, *Silent Spring*; Thomas R. Dunlap, *DDT: Scientists, Citizens, and Public Policy* (Princeton: Princeton University Press, 1981); Thomas R. Dunlap, *Faith in Nature: Environmentalism as Religious Quest* (Seattle: University of Washington Press, 2004), 95-105; Samuel Hays, *A History of Environmental Politics Since 1945* (Pittsburgh: University of Pittsburgh Press, 2000), 52-60, 116-117, 145-146, 208; Ralph H. Lutts, "Chemical Fallout: Rachel Carson's Silent Spring, Radioactive Fallout, and the Environmental Movement," *Environmental Review* 9 (Fall 1985): 210-25; Hal K. Rothman, *The Greening of a Nation?: Environmentalism in the United States Since 1945* (Fort Worth: Harcourt Brace College Publishers, 1998), 83-109; Ted Steinberg, *Down to Earth: Nature's Role in American History* (New York: Oxford University Press, 2002), 239-253; Donald Worster, *Nature's Ecology: A History of Ecological Ideas* 2<sup>nd</sup> ed. (New York: Cambridge University, 1994), 347-387; Terry Tempest Williams, "One Patriot" in *Patriotism and the American Land*, ed. The Orion Society (Great Barrington, MA: The Orion Society, 2002), 39-62.

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## CONCLUSION

The regulatory measures taken in the aftermath of the 1968 sheep kill incident did change the nature of military activity in the West Desert, but unlike the Taylor Grazing Act and other conservation measures of the 1930s, which had long-lasting consequences to the livestock industry, the military restrictions of the late 1960s and early 1970s were largely provisional. Dugway did not close. The talented team of scientists assembled at the installation adjusted to new demands, and in the 1980s President Ronald Reagan's emphasis on defense helped modernize Dugway's test facilities.

The current "war on terror" has further boosted military activity in the West Desert. In December 2001, the Air Force redesigned one million acres of bombing range to emulate the conditions of America's new war. The new target areas, which included caves, tents, simulated villages, and abandoned mines, were designed to give pilots training for "the uncertain warfare and terrain of the Middle East."<sup>1</sup> The Army has also cited "a worldwide threat to the security of the United States from hostile nations" as justification for renovating the old laboratories at the Baker area, where the majority of BW testing was based during the Cold War.<sup>2</sup> Dugway has even become a center for counterterrorism, providing soldiers and civilians with training in "live and simulated biological and chemical environments."<sup>3</sup> Today Dugway employs more civilians than during the Cold War and is Tooele County's top employer.<sup>4</sup>

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<sup>1</sup> "Utah Training Camp Redesigned," *The Daily Camera*, 10 Dec. 2001, <http://web.dailycamera.com/news/terror/dec01/10wpract.html> (accessed 11 June 2007); Erin Johnson, "Air Force Pilots Practice on Afghanistan-Like Terrain in Utah," *The Daily Universe*, 12 December 2001, <http://www.pbs.org/weta/washingtonweek/voices/200112/1211bombing.html> (accessed 11 June 2007).

<sup>2</sup> Stephen Speckman, "Military Wants to Renovate Dugway," *Deseret News*, 2 June 2007, <http://www.deseretnews.com/dn/view/0,1249,660226123,00.html> (accessed 11 June 2007).

<sup>3</sup> Suzanne Ashe, "Dugway Commander Details Past and Future of Army Base," *Tooele Transcript Bulletin*, 23 February 2007, <http://www.tooeletranscript.com/index.php?option=content&task=view&id=19782&Itemid=2> (accessed 11 June 2007).

<sup>4</sup> Dugway, "Final Environmental Impact Statement," 3-154, ES-46 to ES-47; Ashe, "Past and Future of Army Base."

From a historical perspective, it seems that early rhythms have begun to emerge from the West Desert. Similar developments took place in the West Desert in the mid twentieth century when national security was regarded as a task worthy of honor and pride. We know now that success in weapons technology then came with costs. Just as sheep herding transformed the West Desert into a barren place by the 1930s, thirty years of CBR weapons testing inexorably reshaped the West Desert into an ever more marginal landscape. The wide-ranging, complex, and unpredictable environmental consequences still elicit concern. The Army has identified nearly 200 sites within DPG where toxic materials were released into the environment during WWII and the Cold War. These hazardous waste sites threaten air, land, and groundwater resources.<sup>5</sup> From 1979 to 2000, the Army spent nearly \$85 million on assessing and remediating these sites. Future costs are projected at around \$235 million, and restoration is not expected to finish until 2062.<sup>6</sup>

There are also less tangible consequences to the weapons testing program. In the mid 1990s, long-term residents of Grantsville, the town that suffered the most during the 1930s dust storms, were discovered to suffer from abnormally high rates of cancer, multiple sclerosis, and other illnesses.<sup>7</sup> People have tried to connect these high rates to Dugway, yet there was no more evidence to connect these illnesses to testing than there

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<sup>5</sup> Army, "Installation Action Plan," 5, 6; U.S. Army, "Summary of Environmental Cleanup Activities," *Utah Department of Environmental Quality*, <http://www.hazardouswaste.utah.gov/HWBranch/CDSection/CDS/DPG/DPG-WEB.pdf> (accessed 15 May 2007).

<sup>6</sup> Army, "Installation Action Plan," 157-159.

<sup>7</sup> All of Tooele County had high rates of cancer and inordinately high rates of multiple sclerosis, but the studies in the mid 1990s focused primarily on Grantsville. For further details, see Ward, *Canaries on the Rim*, 119-148; Lee Davidson, "Cancer Rates Give Grantsville Residents Cause to Wonder: Residents Conduct their own Survey in Hopes that State will Take Closer Look," *Deseret News*, 10 March 1996; Lee Davidson, "Can Utah's MS Rates be Linked to Tests?: Study Supports Theory, but Research is in the Earliest Stages and Faces Obstacles," *Deseret News*, 31 December 1994; Lee Davidson, "Examine New Data on Grantsville," *Deseret News*, 15 March 1996; U.S. Environmental Protection Agency, "Grantsville Initiative," [http://www.epa.gov/region08/community\\_resources/steward/fact/grntvile.html](http://www.epa.gov/region08/community_resources/steward/fact/grntvile.html) (accessed 15 May 2007).

was to the 1976 wild horse deaths.<sup>8</sup> The fears persist, however, continuing to shape perceptions of the West Desert.

Simply put, locals cannot make up their minds about the West Desert. There are irresolvable tensions between economic opportunity and community health, yet jobs continue to take precedence. Residents, moreover, are dependent not only on the defense industry. Today waste disposal facilities dot the landscape, and an interim high-level nuclear waste disposal site on the Goshute's Skull Valley reservation was also proposed.<sup>9</sup> While the majority of people living in the more economically diversified Wasatch Oasis opposed the site, Tooele County's local civic leaders embraced and promoted the development.<sup>10</sup>

Considering the "incomparably strange history" of the region, Tooele's civic leaders' opinions are hardly surprising.<sup>11</sup> The vision of the West Desert as an empty, unproductive region has operated since colonization, but it was not necessarily representative of what transpired in the region. The West Desert supported Native peoples for countless generations and many settlers considered it a "veritable herder's paradise." The area was critical to the livestock and defense industries, two of the most influential and prosperous forces in the Bonneville Basin. Yet the region's isolation and perceived worthlessness led people to act without restraint. Inexorably, the vision of a wasteland became a reality. A century of use by the military and grazers physically and

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<sup>8</sup> Davidson, "Can Utah's MS Rate be Linked to Tests"; Ward, *Canaries on the Rim*, 119-148.

<sup>9</sup> After nearly a decade of contention the U.S. Department of the Interior effectively blocked the proposal in September 2006 by rejecting a land lease and a right of way to ship the nuclear waste.

<sup>10</sup> Some critics noted that Tooele County stood to make four times as much money as the Goshute tribe on the initial storage deal. For further details, see *Skull Valley: Radioactive Waste and the American West*, DVD, directed by Ken Verdoia (Salt Lake City: KUED-TV, 2001).

<sup>11</sup> Davis, *Ecocide in Marlboro Country*, 50.

conceptually reshaped the West Desert into area that many believed was fit only for sacrifice.

Top secret weapons testing brought the most wide-ranging and detrimental environmental consequences. During testing, there was little consideration for these consequences until after a routine accident killed thousands of sheep. Efforts to uncover the largely hidden history of the ecological impact of military development in the American West have brought increased awareness about the need for accountability and transparency in the defense industry, especially as the tensions between economic prosperity, national security, and ecological health become increasingly apparent. The domestic threats that the defense industry poses to the environment need to be weighed against external threats to national security. Sheep may not be the only casualties next time around.

Today the West Desert is predominantly viewed and treated as a wasteland, yet the region continues to defy such categorization. The very emptiness that attracted the defense industry to the region has been revalued. The West Desert's solitude, along with its geologic wonders, unique biodiversity, and ample recreational opportunities, has become increasingly attractive to outdoor enthusiasts. Wilderness advocates see the region as "a place of inherent value, dignity, and beauty, worthy of protection."<sup>12</sup> To many, the fact that the region is commonly viewed as "a vast carpet under which to sweep our most odious wastes" only emphasizes the need for protection.<sup>13</sup> Some even believe the results of military occupation are worth preserving, arguing that the anthropic landscapes of the West Desert "do not exist in opposition to the beauty of the area, they

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<sup>12</sup> The Wilderness Coalition, *Wilderness at the Edge: A Citizen Proposal to Protect Utah's Canyons and Deserts* (Salt Lake City: Publishers Press, 1990), 46

<sup>13</sup> The Wilderness Coalition, *Wilderness at the Edge*, 49.

exist as components of it. We see in the landscape a reflection of truth. And the beauty of the Great Salt Lake Desert region is only enhanced by a more complete knowledge of its constituents.”<sup>14</sup> Such views inherently challenge the often polarizing effects of conventional views of wilderness, which deem certain landscapes, such as Yosemite or the Grand Canyon, as sacred and others, such as the West Desert, as sacrificial.<sup>15</sup> In the West Desert, as well as other sacrificial zones of the Great Basin, there is a growing awareness that a “portion of the earth thought a desolate wasteland by one ignorant generation can become highly valued by the next, if the next generation grows wiser.”<sup>16</sup> The future importance of the West Desert thus may be its potential to help redefine “our deeply tangled and problematic relationship to the natural world” into something more congruous.<sup>17</sup>

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<sup>14</sup> Land Use Interpretation, *Great Salt Lake Desert Region*, intro.

<sup>15</sup> For the trouble with wilderness, see William Cronon, “The Trouble with Wilderness; or Getting Back to the Wrong Nature,” in *Uncommon Ground: Rethinking the Human Place in Nature*, ed. William Cronon (New York: W.W. Norton & Company, Inc., 1995), 69-90. For arguments in support of preserving monumental landscapes, see Runte, *National Parks*. For arguments in support of deserts as sacrificial zones, see Charles C. Reith and Bruce M. Thomson, eds. *Deserts as Dumps?: The Disposal of Hazardous Materials in Arid Ecosystems* (Albuquerque: University of New Mexico Press, 1992).

<sup>16</sup> Michael Cohen, “The Future of the Great Basin” afterward to Claude Filder’s *A Vast and Ancient Wilderness: Images of the Great Basin* (San Francisco: Chronicle Books, 1997), 119.

<sup>17</sup> Fiege, *Irrigated Eden*, 10.

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