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The desert as laboratory: Science, state-making, and empire in the drylands

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Abstract. In December 2018, the University of Arizona was awarded a $3.9 million contract from the Sultanate of Oman to develop research laboratories for the country's "One Million Date Palms for Oman" initiative. This project is only the most recent example of a much longer set of collaborations between actors in the two regions, which began when Omani date palms were imported to the University of Arizona's Agriculture Experiment Station in the 1890s. In tracing this history, I show how establishing state power in the U.S. West was facilitated by the work of scientists and research institutions drawing on materials and knowledge from the Middle East. In the case of Arizona, the colonial project was advanced through the federally-funded land-grant programs at the University of Arizona, which aimed to entice white settlers to the territory through promoting commercially-oriented agriculture. University researchers' efforts to secure date palm imports from abroad illustrate how the settler colonial vision treated the desert Southwest as an analogue to the Middle East, but their personal laboratory for developing modern knowledge about desert farming. The case sheds light on the role of scientific institutions in consolidating state power in desert frontiers – a process that is depoliticised by framing the desert as a laboratory as a site for "modern" science rather than a site to be colonised.

Keywords: arid lands; agriculture; settler colonialism; U.S. West; date palm; laboratory studies

Figure 1. *View of the One Million Date Palms farm in Sumail, Oman. The UA-supported Central Date Palm Laboratory under development is visible in the background. January 2020. Source: Author.*

1. INTRODUCTION

In December 2018, the University of Arizona (UA) was awarded a $3.9 million contract from the Sultanate of Oman for the country's "One Million Date Palms for Oman" initiative. The university has since been developing new date palm research laboratories outside of Muscat, set to open in mid-2020 (**Figure 1**).[1] But what does Arizona have to do with date palms? Why was UA, of all places, chosen for this project? And what can it tell us about scientific collaborations between the U.S. Southwest and the Middle

[1] For more about the Million Date Palms project and additional visuals, see https://mdp.gov.om/ , https://www.youtube.com/watch?v=Gg1uP92uGBw&feature=youtu.be, and https://www.youtube.com/watch?v=SyS7SJlUdqI&feature=youtu.be

East? As it turns out, the University of Arizona's work on the Central Date Palm Laboratory in Oman is but one case of a much longer set of collaborations between actors in the two regions. In fact, it was thanks to date palms imported from the Middle East in the 1890s – Omani varieties included – that the University of Arizona's Agriculture Experiment Station got its start. This paper examines this history, illustrating how establishing state power in the U.S. West was inextricably connected with the support of science and research institutions in collaboration with places, materials, and knowledges from the Middle East.

Scientific institutions were and continue to be essential to the building and maintenance of American empire, both domestically and internationally. The people and places that have been enlisted in state-making through these channels are diverse. In this paper, I focus on the case of Arizona, where scientific expertise on commercially-oriented desert farming was seen as necessary to entice white settlers to colonise the territory after the Mexican Cession in 1848 and the Gadsden Purchase 1853. Although it was only opened in 1891, the University of Arizona was a central node in white settlers' effort to transform Arizona from a Territory to a U.S. state. As we shall see, the processes of colonising the U.S. West were dependent on scientific frameworks that cast the desert as a "laboratory" to test out ideas and crops from the Middle East. This is vividly illustrated by the UA Agriculture Experiment Station, whose staff actively sought date palm varieties from Arabia and Northern Africa to spur a domestic date industry in the American Southwest – which ultimately undermined the Gulf's lucrative export market in the U.S. by the 1920s.

Over 100 years after UA researchers first treated the Arizona desert as a laboratory for Omani dates, the university's involvement in Oman's One Million Date Palms initiative stands as a powerful symbol of the trans-regional and trans-historical ironies – and logics – of imperialism. I will return to elaborate on today's agricultural connections between Arizona and Oman in the conclusion, but the focus of this paper is on the historical foundations of the date palm connection – tracing the sociotechnical imaginations that have mediated relationships over time and space, between the environment, geopolitics, territory, power, and subjectivity. To do so, I approach the "desert" as a political construct, produced by actors and institutions working to promote modernist Science in arid lands – a process whereby these territories are treated as the site of "mere" experiments, and the desert is cast as a blank-slate laboratory, rather than a site undergoing active colonisation. Part of a longer history of empire in the drylands, the interconnected histories of Arizona and Oman poignantly elucidate how desert agriculture has been vital to state-making in both regions historically and today.

This paper is part of a larger study about connections between Arizona and the Arabian Peninsula, but my present analysis focuses on how date palm cultivation efforts linked the two regions long before the agreement signed between UA and the Omani government in 2018. The research presented here is primarily historic, though I also draw from interviews fieldwork in Oman in January 2019 and 2020, as well as in Arizona from 2018-2020. The archival records used for this project include the holdings of UA Special Collections and Arizona State University, the UA Institutional Repository's (UAIR) History of Agriculture & Rural Life digital archive, the Arizona Historical Society, the Arizona Memory Project, and the HathiTrust Digital Library. I also conducted systematic searches of U.S. newspaper databases to collect relevant news articles from the late 1800s onward, including approximately 75 individual articles, primarily from Arizona and California.

Reading the many layerings of this colonial history alongside contemporary dynamics is challenging because of the multiple spatial and temporal scales that are implicated in the analysis. To do so, I unite multiple threads within political geography and environmental history with insights from laboratory studies to trace the colonial past and present of the U.S. Southwest. Laboratory studies is an interdisciplinary field, but most strongly associated with STS (science and technology studies). This research has largely focused on traditional laboratories themselves (e.g. Latour and Woolgar, 1979; Traweek, 1988), though its insights have been productively expanded to consider how other places, such as entire colonial domains, have been treated as "laboratories" (e.g. Barry, 2001; Beattie et al., 2016; Tilley, 2011; Saraiva, 2016; Scott, 1998).[2] In this paper, I am especially concerned with how the desert itself has

[2] The laboratory studies literature is too large to review here, but see reviews in Doing, 2008; Kirsch, 2011.

been imagined as a kind of laboratory – not just for science in the traditional sense, but also as a project in social engineering, whereby Anglo-American ideas of "civilisation" are to be tested out in geographic settings perceived as starkly different from previous zones of expansion.

2. SCIENCE, EMPIRE, AND THE DESERT AS LABORATORY

The desert has been imagined as a kind of laboratory in many different cultural contexts. Whether it is for novel architectural models, testing the limits of human survival and technology, experimenting with new energy economies, or a special site for nuclear weapons testing, the idea of a desert as a blank slate has been harnessed by states and scientists alike to transform the arid lands of the world into the very wastelands they are so brazenly said to be (Davis, 2016; Kuletz, 1998; Masco, 2006; Voyles, 2015). A different kind of technoscientific intervention seen across history rather seeks to transform the desert into a blossoming paradise. Wreaking a different sort of havoc on natural systems, schemes to green the desert also represent a form of violence – albeit in ways that their proponents more easily deflect through harnessing the spectacle of transforming the ostensibly "barren" into something "productive" (Koch, 2015, 2019; Molle and Floche, 2008; Trottier et al., 2020). Indeed, as many scholars have shown, western expansion of the U.S. was underpinned by efforts to both map the territory and to "conquer" it by bringing it under cultivation (Akhter and Ormerod, 2015; Blackhawk, 2006; Burtner, 2012; Conrad, 2014; Curley, 2019; Evans, 2017; Frymer, 2017; Isenberg and Kessler, 2017; Isenberg et al., 2019; Knobloch, 1996; Meeks, 2007; Morrissey and Burtner, 2019; Sayre, 2017; Smith, 1950; Teisch, 2011; VanderMeer, 2010; Worster, 1985).[3]

Settler colonial ideals of Jeffersonian agrarianism historically framed the desert landscapes of the West as a serious challenge to the civilising mission of American expansion. For an extended period of America's colonial history, deserts were deemed deficient and dangerous (Davis, 2016; Isenberg et al., 2019). However, as the settler gaze started to shift westward and technology evolved, new narratives about the "miracle of irrigation" advocated agricultural expansion in the west. For the author of one 1900 book, *The conquest of arid America*, agriculture was fundamental to the U.S. colonial project because "its relation to a future civilization in a broader sense will be momentous. It is, indeed, a fateful crop, trembling with the hopes of humanity, that is beginning to sprout from the arid soil of the far-western deserts" (Smythe, 1900, p. 35). He also describes the arid West of North America through the familiar colonial tropes of emptiness: "It lies there now a clean, blank page, awaiting the makers of history—the goodly heritage of our people" (Smythe, 1900, p. xvi). Colonisers actively emptied this land, not just by displacing Indigenous communities and taking over their lands, but also taking over access to water and other vital resources needed for agricultural expansion. In the U.S., this unfolded through manifold acts of violence, broken treaties, and legal structures of exclusion – and science (Biolsi, 2005, 2018; Brown, 2001; Churchill, 1993; Curley, 2019; Daigle, 2016, 2018; Estes, 2019; Lindsay, 2012; Meeks, 2007; Porter, 1999; Shih, 2019).

A great deal of scholarly attention has focused on the most violent aspects of this genocide, but the colonial project was also bolstered by federal policies to encourage farming, such as the 1862 Homestead Act and the Desert Lands Act in 1877. In Arizona, for example, would-be farmers were regaled with promises of fortune and prosperity in brochures and other boosterist materials designed to entice settlers to the Territory in the 1800s and early 1900s (**Figure 2**). These documents proclaim the region's agricultural promise, often set in contrast to the commonplace images of frontier lawlessness that local boosters sought to shake. For example, Central Arizona is described thus:

> To-day it best is known as the refuge of the health-seeker, for its wondrous scenery, for its mines of wealth, and for its great agricultural Valley of the Salt River. It is no longer the frontier—the sweeping wave of civilization has covered it. The cactus has been thrust back and the plain has been made a garden, threaded by great canals wherefrom the farmer draws for the irrigation of his fertile acres. (Hamilton, 1800s, p. 2)

[3] Beyond the rich body of research on the U.S. West, there is a vast literature on water, agriculture, and empire in other desert settings, which cannot be reviewed here, but for an introduction see Davis, 2016.

These texts also consistently note that the (perceived) threat of Indigenous attacks on white settlers has subsided: "The Arizona Indian of to-day is no longer savage. He is still picturesque, but is rapidly being merged into a most ordinary division of the body politic" (Hamilton, 1800s, p. 11). The author goes on to explain that local Indigenous communities will become a "great labor reserve" for agriculturalists, but they are not framed as farmers themselves. Rather, the boosterist literature published by institutions like the Chambers of Commerce for Tucson, Phoenix and Maricopa County, Southern Pacific Railroad, City and County Immigration Commissioners, as well as independent "immigration solicitors" all portray the opportunities available to *white* farmers from the east, who were the desired settlers for state-builders in the Arizona Territory.

Figure 2. *Mix of Arizona settlement brochures issued by the Arizona Commission of Immigration T.E. Farish (1889), the Phoenix and Maricopa County Board of Trade (1800s), and Southern Pacific Railroad (1906). Part of the UAIR's History of Agriculture & Rural Life digital archive.*

The idealized vision of the farmer, exemplified in **Figure 3**, was to become the hero of the evolving imagining of the U.S. West as territorial expansion demanded "a revision of the forbidding image of an American Sahara. The imaginary figure of the wild horseman of the plains would have to be replaced by that of the stout yeoman who had for so long been the protagonist of the myth of the garden" (Smith, 1950, p. 179). The brochure in Figure 3 does not just visually promote the white settler image, it also aims to furnish these individuals with the institutional knowledge to take advantage of the federal government's Homestead and Desert Land Laws, which would give them access to farmland in the western territories. It fits squarely in the broader policy agenda of American expansionism, which Paul Frymer (2017, p. 25) notes worked to create a new racial geography of white immigrants to control the West, "not simply for resource extraction but also for planting 'Americans' on the land for purposes of settlement and community." Given the overarching weakness and limited state capacity of the U.S. at this point in history, he argues, "one of the most prominent weapons that the federal government had at its disposal […] was its ability to control public land" (Frymer, 2017, p. 23). Distributing "public" (stolen) land was a critical aspect of federal efforts to territorialise state-power on the frontier, but this was not solely a concern of Washington bureaucrats; advocates of statehood in Arizona were also preoccupied with state weakness and the racial geographies they saw as threatening their takeover of the region since it was ceded by Mexico in 1848.

Figure 3. *Cover of a brochure outlining U. S. government's Homestead and Desert Land Laws, issued by the Atchison, Topeka and Santa Fe Railway Company (1910).*

One of the major obstacles to Arizona's push for statehood in the early 1900s was the perception among Washington, D.C. lawmakers that the territory was home to too many "non-white" residents (Frymer, 2017, pp. 175-176; Meeks, 2007, pp. 36-43) – an ambiguous designation then as now, but one that nonetheless gave additional impetus to the agriculturalists' efforts to recruit Anglo-American settlers from the East coast. Historians have emphasized the central role of the Homestead Act and other land laws in early American state-making, but U.S. legislation focused on expanding the country's university system, and in particular agricultural education, was also vitally important to the colonization of North America. The most important was the Morrill Act of 1862, also known as the Land-Grant College Act, which was later buttressed by the Hatch Act and the second Morrill Act of 1890. Together, the three acts served as the legislative basis for the "land-grant" college system designed to support colleges specializing in "agriculture and the mechanic arts" (Geiger, 2015, pp. 303-304; Kloppenburg, 1988). Through the Morrill Act, designated land-grant institutions were given huge tracts of federally-controlled land – most of which was taken dubiously or illegally from Native Americans – to help raise their initial endowments. Most quickly sold off the land to raise revenue, though a handful of universities still control these parcels today (Lee and Ahtone, 2020). The Morrill and Hatch Acts were, at one level, about supporting the development of higher education, but they were ultimately part of a much larger scheme of Indigenous dispossession and the effort to add a "noble" sheen to the theft of land. As the next section discusses further, the Hatch Act funding that supported land grant colleges in setting up agricultural experiment stations, which is was precisely what accelerated the University of Arizona's precarious start. The UA and so many other scientific institutions like it were, and continue to be, essential building blocks for state formation and American empire.

Within this broader perspective on American empire, the desert can be understood as what Andrew Barry (2001) refers to as a "technological zone." That is, the desert-as-laboratory is an imaginary space that takes "varied spatial forms which may both reinforce or cut across and subvert formal political boundaries,"

but ultimately joins actors across space and time through the production of science and technology (Barry, 2001, pp. 60-61). The material properties that characterise deserts are an important part of this story, but this paper emphasizes the agency the human actors that narrate the "desert" as a socioecological space – one that can be discerned, dissected, and distinguished from other spaces for the scientific gaze. In this case study, those actors are the administrators and researchers involved in setting up the University of Arizona's Agricultural Experiment Station in the 1890s, as well as their collaborators in the federal government and the private sector. While they all come together to advance agricultural interests in the Territory of Arizona and, later, the state, the mantle of science adopted by the UA-based actors is especially powerful in legitimating their efforts. Framing the Sonoran desert as their dedicated laboratory was, in turn, crucial to building this narrative (Burtner, 2012).

While this paper focuses on the case of the UA Agricultural Experiment Station, it is important to note that it was not the only such effort to promote science in the Arizona desert at the turn of the century. A number of astronomy-related sites were also developed across Arizona from the 1890s on, which Conrad (2014, 606) points to as evidence that "the Southwest in the early twentieth century was a 'colony' of American science" (see also Lane, 2011). Webb's (2002) *Science in the American Southwest* offers a broader overview of these multiple ways of imagining the desert-as-laboratory, but another notable example at this time was the Desert Laboratory on Tucson's Tumamoc Hill. It was founded in 1901 by two botanists from the East Coast, Daniel MacDougal and Frederick Coville, who had become enchanted with the plants of the Southwest. They managed to secure support from the Andrew Carnegie Institution to fund their "Desert Botanical Laboratory," laying out an ambitious agenda of researching "desert plant life of the whole world" (Wilder, 1967, p. 183). Researchers eventually developed wide connections to other arid regions of the world through the language of desert botany, though it had a markedly different agenda from UA's orientation toward advancing commercial-farming. It was, after all, a product of the agrarian-nationalist vision of the Hatch Act.

Laboratories can be imagined in many different ways. This multiplicity is important because they key sites for the production of expertise. Working in a particular kind of laboratory allows researchers to claim expert status in a particular domain. In the case of Arizona researchers, these claims have been tied to expertise in arid lands science. A long line of (almost exclusively) men – some of whose stories we will encounter below – have cultivated this expertise to advance their careers, as well as their personal and political interests. Positioning themselves as arid lands scholars, these individuals were instrumental to establishing state power in Arizona from the late 1800s on, and which they then went on to apply in building U.S. empire in the Middle East (Jones, 2010; Koch, 2019, forthcoming; Tesdell, 2015; Vitalis, 2007). Long before America's "desert kingdom" was imagined to be in the sands of Arabia, researchers, politicians, and entrepreneurs (sometimes one and the same) were busy building their own empire on the Western frontier, united around a common project of bringing the desert under cultivation. Indeed, beyond mere parallels, this case study illustrates the intimate ties between those claiming arid lands expertise in Arizona and Arabia beginning in the late 1800s – and continuing in new ways ever since. UA researchers are still actively involved in various agricultural issues in the region, ranging from introducing greenhouse technologies to supporting the most recent project to develop the Central Date Palm Laboratory in Oman. To understand how this process began, we must look to the founding of the University of Arizona and the Agricultural Experiment Station.

3. THE UNIVERSITY OF ARIZONA AND THE AGRICULTURAL EXPERIMENT STATION

Establishing a university was first considered shortly after Arizona was recognised as a Territory by Congress in December 1863. The project floundered for decades, but was finally authorised for development in Tucson by the Territorial Legislature in 1885 and a Board of Regents was created. The Legislature only partly funded the college though, so even after land was secured and ground was broken in 1887, the first campus building remained incomplete by 1889. But that summer, "the hopes of the university regents soared" (Mitchell, 1985, p. 17) when they learned they could access funding from the recently-passed Hatch Act of 1887 and solve their financial woes. As a supplement to the 1862 Morrill Act, the Hatch Act provided annual grants of $15,000 to land grant colleges for establishing and operating

agricultural experiment stations. After a successful application, the UA Regents received federal funding beginning in June 1890. They quickly set about developing an agriculture station (which had existed on paper only when they applied for funds) and hired the university's first professor, Frank A. Gulley. Gulley had previously served as Texas A&M's Experiment Station director, but now assumed the role of Dean of the College of Agriculture and became the first Director of the UA experiment station (Mitchell, 1985, p. 18; Rice, 1978, p. 124). His vision for the Arizona Agricultural Experiment Station (AES) was to prove deeply influential in the future trajectory of the university, as well as the state more broadly.

From the outset, the Arizona AES was folded into the agrarian colonial ambitions of the Morrill and Hatch Acts. In the mid- to late-1800s, when agrarian interests became a powerful force in national politics and advocates used that influence to shape federal policy (Geiger, 2015, pp. 304-306). Agriculturalists faced serious challenges in the sphere of higher education, however, as many students did not actually need the instruction on offer or, as commonly occurred, left the farming community entirely after a college education opened their perspective on alternative careers. The contemporary debates about how to address this are detailed by Roger Geiger (2015), but suffice it here to say that the Hatch Act's support for agricultural experiment stations was the product of these debates. As part of the land grant colleges' broader mission to serve their local communities, these research stations were envisioned as places to facilitate the transfer of science-based findings to local farmers, without necessarily co-opting the farming communities themselves through direct college enrolment.

This vision was outlined by the station Director Gulley in the first AES bulletin, issued in December 1890. Gulley's opening statement justifies the institution's intended focus on particular crops (fruit) and his rationale for the four research stations' location within the state (one in Tucson, two in the Phoenix area, and one near Yuma), but notes: "It is the desire of the management of the station, to make the work of the greatest practical value to the residents of the Territory. We shall be pleased at all times to receive visitors at the stations and have our work inspected, and suggestions in regard to work in progress, or new lines of work, will receive our careful consideration" (Gulley, 1890). While this paper focuses on date palm projects, Gulley's crop experiments included everything from citrus, sugar beets, cotton, grasses and forage crops, and more. As Webb (2002, p. 6) notes in his extensive history of science in the Southwest, over 400 different plants were cultivated at the Arizona agricultural stations within the first several decades of opening – ostensibly searching for crops that would advance the farmers' interests in the state.

As noble as Gulley's vision for the AES was crafted to be, the stations' work of "practical value" to Arizona "residents" was not intended for all: it was intended to support the ambitions of the white settlers of the territory. Such a vision for the Arizona station was not exceptional. The Hatch Act facilitated the development and expansion of similar agricultural experiment sites across the U.S. (Hightower, 1973). The rich funding it offered supported the institutional mechanisms for the state's scientific support of agriculture as a science in an austere time, while also working to colonise the land through territorialising state institutions and giving material support to vision of a place organized by and around a white settler community of farmers – the yeoman protagonist of Smith's (1950) famous accounting in *Virgin Land.* The University of Arizona case also shows that the reach of the Hatch Act extended well beyond supporting the white farming communities themselves. It also helped to institutionalise the broader reconfiguration of nature-society relations in the region by promoting commercially-oriented farming, which was the vision of the "modern" scientists working to advance agriculture into the arid West. And to do this meant re-engineering waterways through massive irrigation schemes and displacing Indigenous communities and revoking their access to fields, water, and the freedom of movement (see Blackhawk, 2006; Curley, 2019; Churchill, 1993; Meeks, 2007).

Indigenous groups, including the Pima, Navajo, Gila, and Maricopa, among others, were significant players in agriculture in Arizona into the mid-1800s. But after decades of direct and indirect policies assaulting their sovereignty, their agricultural economies had collapsed (Meeks, 2007, pp. 34-35). Thus, by the time the AES began in 1890, its staff could portray the desert as a laboratory for exploring the frontiers of farming in the desert. Rice recounts of the station's early years:

> At first, the Experiment Station staff shared the bewilderment of the farmers, knowing little about arid-land agriculture themselves, but they quickly began research at branch stations

> around the territory and soon were providing suggestions for coping with a multitude of agricultural problems. By the outbreak of war in 1917, the Experiment Station was playing a prominent role in the agricultural boom sweeping the state of Arizona. (Rice, 1978, pp. 123-124)

And yet, despite the settler's bewilderment at the unique character of the desert Southwest, Gulley boldly wrote to the Assistant Secretary of Agriculture in July 1891 to ask for his support in the AES effort to collaborate with the Office of Indian Affairs, explaining:

> There are two reasons why we desire to take up this work: First, we want to commit the University in its organization to the education of the Indians as well as the white people of the Territory, and while the ordinary Indian schools are well enough in their way, we believe some method of setting the Indians to work and leading them to earn money and increase their wants, particularly a desire to live like human beings is the only practicable plan by which any permanent good may be secured.
>
> To educate the young Indians, boys or girls and then send them back to the Reservation may be satisfactory to those well meaning people of the east who know nothing of the Indians or of the way in which they live on the Reservations, but the effect on the Indians themselves is demoralizing. We believe we can form a nucleus of industrious Indians and provide a plan whereby some of the boys and girls from the schools will be afforded an opportunity to grow up into good citizens it is true, but under different influences and surroundings.[4]

Problematic as it is, Gulley's proposal apparently failed. The UA Agricultural Experiment Station never had a dedicated effort to include Indigenous communities, nor did I encounter any follow-up to this proposal in the archival records or secondary accounts.

Nonetheless, the ideal of bringing civilisation to the frontier – whether patronising or violent – remained a vivid trope in institutional narratives about the University of Arizona for decades after Gulley's letter. For example, written decades later, Douglas Martin's (1960) book about the university's history, *The lamp in the desert*, is filled with the most abhorrent racist language about Indigenous inhabitants of the region, which I shall not quote here. Remarkably, though, the UA's then-president Richard Harvill penned a glowing Foreword to the text, noting:

> The story of the University of Arizona is closely interwoven with the history of the state and, in *The Lamp in the Desert*, Professor Douglas D. Martin has told this story dramatically and with delightful touches of humor. He has told it with realistic understanding, both of pioneer days and of developments since those days, and the University of Arizona is deeply grateful to him. (quoted in Martin, 1960, p. vi)

Like Gulley, Harvill also asserted that the university is "dedicated to the service of the people of Arizona" (quoted in Martin, 1960, p. v). For decades, the Indigenous people of Arizona were not only left out, but actively harmed by policies that advanced the interest of white settlers above all others. These men and other institutional trailblazers could largely make this claim, I want to suggest, on the basis of articulating the desert as a special laboratory for their technoscientific visions of modernity. They were operating on the basis of a smooth, emptied laboratory space, detached from the messy complexities of politics, greed, and Indigenous erasures that were the condition of possibility for their vision of science and agricultural advances in the desert. Another key input for this imperial project were the social and material resources Gulley and his successors derived from the Middle East.

4. DATES IN THE CIRCUITS OF EMPIRE

The first shipment of Omani date palm to Arizona were received at the Tempe Experiment Station in September 1891, labelled as Fard, and sent by A. Mackirdy, U. S. Vice-Consul at Muscat (Toumey,

[4] UASC AZ 406 Box 1, 1891 Letterbook, F.A. Gulley. Letter to Hon. Edw. Willits, As. Sec., Agricultural Dept., Washington, D.C., July 18th, 1891.

1898, p. 114). They did not fare well, dying shortly thereafter. Yet they were a symbolic step toward a grand vision for transforming Arizona into a laboratory for commercial farming advances in the U.S. Southwest. Even before the University of Arizona officially opened in October 1891, Frank Gulley set out in the fall of 1890 to tour the Territory and learn about how best to promote the interests of commercial farmers in Arizona (Rice, 1978, pp. 125-126). The farming community convinced him of their strong interest in fruit production, which he ultimately adopted as the primary focus of the new Agricultural Experiment Station. In the first AES bulletin quoted above, he explains: "As fruit growing promises to be one of the leading industries, and as at present, and for some time to come, experimental knowledge of what to grow, and how to grow it, will be questions of great importance, it has been thought advisable, without neglecting other interests, to give the subject of fruit growing the special attention of the station" (Gulley, 1890). Although administrative conflicts led to Gulley's departure from the UA in 1894, his passion for fruit trees laid the groundwork for the Experiment Station's subsequent directors, James W. Toumey and Robert H. Forbes, who became a major proponents of the university's first experiments with date palms. Gulley, Toumey, and Forbes all worked with private and government agents to import diverse date varieties from around the Middle East through the 1890s and early 1900s.

The foremost historian of date culture in the United States, Charles C. Colley, opens his article on the industry in Arizona noting that, "Although it is fairly well known that the present date growing center of the United States is near Indio and Palm Springs in the Coachella Valley of Southern California, it is not so widely known that this industry was initiated in Arizona" (Colley, 1971, p. 55). What is also relatively unknown in the U.S. today is that dates were an extremely popular commodity throughout the 1800s and early 1900s. It had an important cultural cache within the United States, beginning in the early 1800s when it was imported as a confection from the Middle East. When records began in 1824, 44,425 pounds of dates were shipped to America and increased dramatically over the rest of the century (Colley, 1971, p. 55). By 1885, the country was importing more than 10 million pounds of dates annually, growing thereafter to 10 to 20 million pounds annually between 1893 and 1903, and by 1920, imports were up to 32 million pounds and then 53 million pounds in 1922 (Hopper, 2010, p. 163). These dates were primarily coming from the Gulf region, with Muscat, Oman at the centre of the trade. Matthew Hopper summarises this history so well that it is worth quoting at length:

> Muscat was the center for Arabian date exports, and Oman was home to particularly hardy varieties of dates that could survive lengthy sea voyages and ripened earlier than most dates on account of Oman's southern latitude and intense summer heat. The fardh variety of dates ripened in August, allowing American ships enough time to load dates at Muscat, catch the monsoon winds, trade at Zanzibar, and make the hundred-day journey home in time for the winter holidays. As American ships commonly returned from their voyages in the autumn, the arrival of Arabian dates in New York before Thanksgiving became an American tradition. Although fardh dates were not highly regarded in Arabia, Americans loved the sweet, sticky variety, and grocers stocked and sold millions of pounds of the fruit annually as a holiday confection. Grocers would use an ice pick to chisel off portions of blocks of sticky dates and sell them by the pound. The annual autumn arrival of ships from Arabia catapulted dates into their unlikely role as an American holiday tradition. (Hopper, 2015, p. 53-54)

Thus, when Gulley did his seminal tour of Arizona and heard of the white farmers' interest in fruit production, combined with his knowledge of certain climatic and soil similarities with Oman and other date-producing countries, research the potential for date farming in Arizona was a logical choice.

Furthermore, as the many histories of date cultivation in Arizona are quick to point out, the very first dates in the region were grown from seeds brought by Spanish missionaries and planted at missions in California and Arizona (see Rivera et al., 2013). By 1882, when date imports were just beginning to take off, the United States Department of Agriculture (USDA) sent an agent, W. G. Klee, to survey the Southwest to evaluate the possibilities for establishing a domestic date industry in the region (Colley, 1971, pp. 55-56). He was later sent back for a more comprehensive study and his reports must have been favourable enough to encourage the USDA to start procuring date palm offshoots for testing at multiple

agricultural experiment stations in Arizona, California, and Texas. The first of these arrived in 1890. By this time, farmers and scientists knew that date palm seeds could not be trusted to produce new palms, whose fruit was true to their source, or in many cases, any fruit at all. As such, date palm farmers have traditionally worked with palm offshoots, which grow at the base of a tree. With the help of various government-employed plant explorers, such as Walter Swingle and David Fairchild, as well as some private producers like Bernhard Johnson, traveling across the Middle East and Northern Africa, "from 1890 to 1929 the USDA imported 1,076 lots of date offshoots containing about 20,000 individuals of 149 standard date varieties" (Hodel and Johnson, 2007, p. 3).[5]

In the early period of palm imports, many offshoots fared poorly. For example, a number of the palms sent to Arizona's AES in the first 1891 shipment died shortly after their arrival. University staff and other importers attributed this primarily to the poor packing and shipment methods, which they subsequently worked to improve. When serving as the AES acting director, Toumey was undeterred by the early failed experiments. In a dedicated AES Bulletin on the date palm (**Figure 4**), he writes: "It would appear that we are justified in making the statement that Southern Arizona has the requisite climate and soil conditions necessary to grow dates on a commercial scale. This statement is not based entirely upon the similarity of the meteorological and soil conditions of Southern Arizona to those of the date regions of the Old World. It is largely based upon results already obtained in growing the date palm in various localities throughout this region" (Toumey, 1898, p. 148). Toumey was succeeded by Robert H. Forbes in 1894. He held the AES directorship until 1915 and eventually came to share Toumey's enthusiasm for commercial date farming in Arizona.

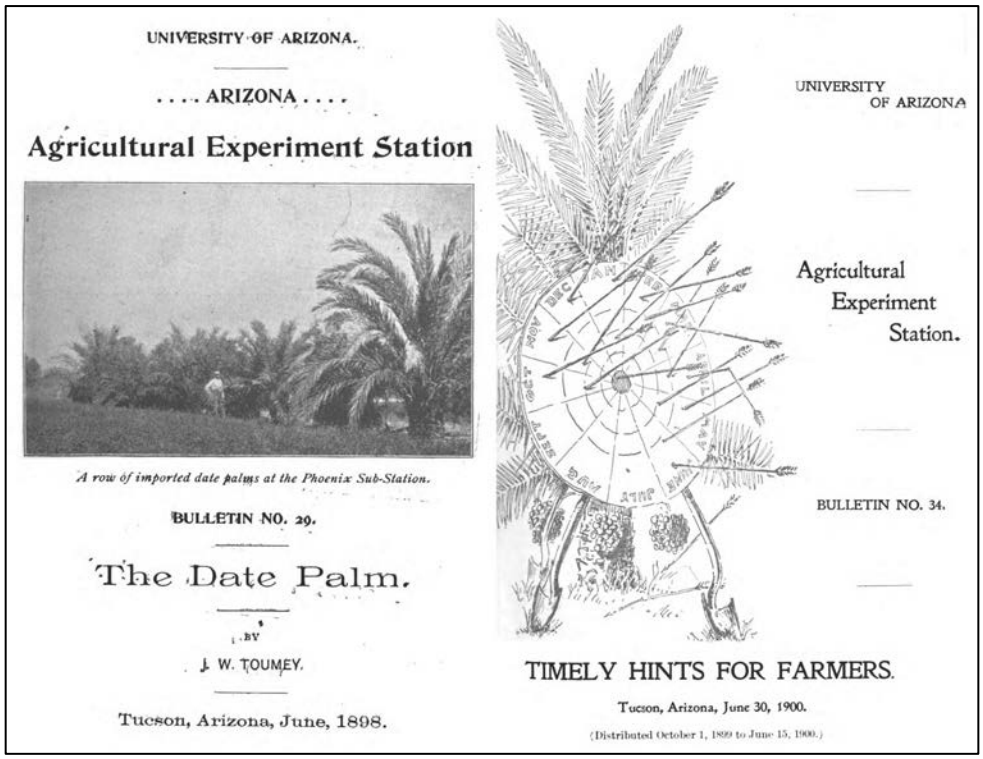

Figure 4. *University of Arizona's Agricultural Experiment Station bulletin covers, including a full issue on the date palm (Toumey, 1898) (left) and one featuring advice for farms about date palm cultivation (UAAES, 1900) (right).*

[5] For historical accounts of these travels and trials, see Fairchild, 1903, 1938; Neef, 1907; Popenoe, 1913; Swingle,1904. For more recent histories, see Colley, 1971, 1977, 1983; Haney, 1985; Hodel and Johnson, 2007; McCarthy, 2012; Rice, 1978; Wright, 2016.

In considering how to advance U.S. date production, Forbes also drew the common comparisons with the "Old World," from where he understood expertise and palms themselves would necessarily be derived until the industry was established:

> But in the date growing countries of the Old World the Arabs, and other races, have developed the date until in excellence and variety it corresponds with other cultivated fruits. Knowing that the conditions, especially of climate, enable the tree to produce in Southern Arizona, it is evidently necessary to avail ourselves of the centuries of Old World experience, bring the best varieties from the Sahara, Egypt and Arabia, and establish them here. This is what the Arizona Experiment Station with the help of the Department of Agriculture is now doing. (Forbes, 1900, pp. 107-109)

Both Toumey and Forbes authored many such treatises, but these examples illustrate the distinct value they saw in re-deploying the agricultural insights of "Old World" communities to the U.S. Southwest. Their arguments fit squarely in a broader American narrative at that time and for decades afterward of imagining the American West as the "Orient," masterfully detailed by Richard Francaviglia (2011) (see also Seekatz 2013, 2016). Publications on dates and other agriculture topics in the desert Southwest at the time are brimming with references to the Middle East and parallels to the Colorado River basin as the American "Nile." These authors' romantic portrayals of exotic Arabia subtly bolster the idea that American settlers are working with a blank-slate desert, on which "Old World" culture can simply be transposed, while continuing to excise the Indigenous peoples and their own agricultural contributions long before the date palm experiments. Instead, these communities are most commonly ignored outright in contemporary accounts of Arizona farming or, as in the 1900 AES bulletin cover in **Figure 4**, reduced to a set of tropes set in opposition to settler farming interventions in the region.

Through their work at the UA Agricultural Experiment Station, the major contribution that Gulley, Toumey, and Forbes made to Arizona agriculture was thus in reimagining the region as an American Middle East, which just needed the right inputs to bring the land under cultivation and the people into line with their Anglo-American vision of civilisation. Originally from Illinois and trained in chemistry and agricultural, Forbes in particular was an evangelist for this desert-to-desert learning and "became convinced that the arid Southwest would improve its agricultural production by borrowing heavily from desert countries" (Colley, 1983, p. 281). Like his predecessors, Forbes found eager allies among the USDA agricultural explorers like Swingle and Fairchild. As their extensive correspondence in Forbes' papers in UA Special Collections and the Arizona Historical Society illustrates, these men not only shared this vision of bringing Middle Eastern insights to the arid West, they were also united by a fundamental trust in the scientific data that showed similarities between the soils and climates of the two regions – as well as the results of their own experiments across Arizona and California.

The early advocates of date farming in the Southwest also found eager allies in the press, which amplified their work far and wide. The seductive image of prolific palms was a consistent theme in the boosterist literature about Arizona at the turn of the century, but also in nearly all publications about the UA itself. The media also reported extensively on the AES work with date palms and the promise of domesticating this industry. Predictably, these reports likewise stress the blank slate narrative, in which the desert becomes the white settler's laboratory: "It is now proposed by our Commissioner of Agriculture at Washington to make the date a staple American product also. The center of this new enterprise is to be the now useless desert regions of southern California and Arizona. Seed has been procured in Egypt and successfully planted, and more is coming" (*Scientific American*, 1878, p. 175). Subsequent articles herald the efforts of USDA representatives in traveling great distances to Arabia and Northern Africa to collect the "best varieties" of date palms for import – "on a mission which the department hopes will open a new and profitable industry in the most arid sections of our Southwest" (*Scientific American*, 1899, p. 284). In many cases, the findings of the Arizona Experiment Station are cited as evidence of the viability of the industry: "The faculty at the Arizona university have conclusively demonstrated that dates can be made a profitable crop in the Salt River valley" and that their production figures illustrate that "the arid plains and valleys of the southwest were really fit for something" (Woolley, 1916, p. 244), The *Arizona Republic*

(1910a, p. 2) likewise celebrated Forbes' efforts in showing that "even the choicest of the old world varieties of dates may be produced to perfection in Arizona."

For the settler contemporaries, the date palm experiments were declared an "unqualified success" (*Arizona Republic,* 1910b, p. 7). This proclamation is a vivid example of how the agents of American empire extended the frontier into the western drylands through the channels of science and research institutions. For those communities politically and culturally excluded from this vision of a modern, commercially-oriented agriculture, however, the AES date palm story was anything but a success. It represented instead a firm intuitional hold – government- and university-supported – on Arizona's socioecological present and future. This was a present and future defined by white settler farms and, eventually, recognised and affirmed by U.S. statehood and all the land and water policies of Indigenous dispossession that followed in subsequent years. Treating the desert as a laboratory for "experimenting" with foreign crops made these acts of dispossession seem noble and in the interest of advancing arid lands science and agriculture. This rhetorical move was not just a rearticulation of the U.S. Southwest as the settler's domain – it was built through a sprawling architecture of legislation like the Morrill and Hatch Acts, institutions like the UA and the AES, and individuals like Gulley, Forbes, their successors, and their allies.

The early date experiments, while only one set of countless other agricultural tests across America, are exemplary of the U.S. agricultural industry's rise to prominence through the work of university researchers and the USDA aimed at collecting and domesticating foreign crops. Imported produce varieties were essential to building the state's commercial agricultural industry in the American West, which is now especially prominent in California (Melillo, 2015). Indeed, despite the key role of the AES and other Arizona-based advocates, date production in the U.S. is now concentrated in California, surpassing Arizona by around 1915. The date industry was set for a steady decline in Arizona after 1950, due to weather challenges, increased production costs, foreign competition, widespread availability of sugar after World War II, large-scale urbanization in the state, as well as competition for California producers (Hodel and Johnson, 2007, p. 6; McCarthy, 2012, p. 51). Arizona's fledgling date industry was not the only casualty of competition from California: the AES "success" story also had significant impacts for Oman and other date-producing countries in the Middle East and North Africa.

The U.S. efforts to establish a domestic date industry eventually contributed to the collapse of the Gulf region's most lucrative export market by the late 1920s. Dramatic changes in trade and shipping patterns in the 1920s and 30s dealt a crippling blow to the date industry in Oman. It quickly fell behind as U.S. demand was increasingly satisfied by Arizona and California producers. As Hopper notes, "Just as quickly as the expanding global economy created vibrant export industries in the Gulf, it ushered in their demise" (Hopper, 2010, p. 172). The demise of Omani date economies is also tied to the shifting geopolitics of slave trade: the date sector's viability depended largely on slavery, which was not actually outlawed there until 1970 (for more, see Hopper, 2010, 2015). The full account of this issue rests outside of the scope of this paper, but this fact alone reminds us that easy binaries of "centre"/"periphery" and "victim"/"victimizer" rarely capture the "historical contingencies and power dynamics mediating movement in some particular ways but not others" (Pritchard, 2012, p. 605). In both the U.S. Southwest and the Arabian Peninsula, the desert technozone, the desert-as-laboratory, has been a site of constant spatial, temporal, and social flux – but one that diverse actors across scales have successfully harnessed to promote broader state-making processes of colonialism and the territorialisation of state power.

5. CONCLUSION: FROM ARABIA TO ARIZONA AND BACK AGAIN

Treating the desert as a laboratory for the settler colonial vision of "civilisation" through agrarian mastery was an important tool in territorialising a particular vision of U.S. power. The AES desert farming projects were just one part of the effort to build American empire domestically, but they offer useful insights into how control over the land in the arid Southwest was solidified through alliances between early settlers, farmers, scientists, and federal institutions. They are also indicative of how early American empire abroad was rooted in developing U.S. dominance in international agricultural supply chains and ultimately exporting its "modern" agricultural expertise and science. But this form of empire was built on a story of

"benevolence" and collaboration with distant places. The impulse of the early AES directors to build bridges with the Middle East was guided by an extractive logic of taking foreign crops and making them their own success story. But they learned to frame this in the language of scientific collaboration, which was facilitated by the laboratory ideal – a desert in one part of the world is imagined as the equivalent of a desert in another part. So while these men may have been the first Arizona researchers to build the case for collaboration through the language of arid lands science and the need for special agricultural knowledge of the "desert," they were far from the last.

Like then, scientists and administrators today routinely harness the idea of Arizona as a special desert "laboratory" to justify highly specific arid lands research, but to affirm the university's founding vision of developing *modern* agricultural science that attends to the unique climatic conditions of the drylands. UA history shows how this has been essential to the state-building agenda in Arizona, while also proving to be lucrative for the university and its researchers as they managed to secure federal support for this mission. The situation is not entirely different today, albeit differently configured. UA eventually closed the experiment stations in the Phoenix area, but they have always maintained the Yuma station, which is now part of the Yuma County Cooperative Extension. It is here that the university has continued to work with date palms and promote date farming locally, largely through the efforts of Glenn C. Wright. Like Gulley before him, Wright came to Arizona from Texas A&M and set about learning about local farming interests when he arrived in the 1990s. Originally specialising in citrus horticulture, he was quickly led to focus on date production and rapidly became a leading voice in the international community of date researchers and producers. Wright's unique expertise in dates, removed in some ways but not others from the UA's history with date research over 100 years ago, has given the UA a special place among American universities in this field.

It is precisely this reputation that led the Omanis to seek them out as institutional partners. The "Million Date Palm Plantation Project" (MDP) began in 2009, with support from the late Sultan of Oman, Qaboos bin Said al Said, and is a government-sponsored initiative based in the Diwan of Royal Court with the stated aim of "establishing a modern date palm sector in the sultanate" (MDP, 2020). Part of the country's broader economic diversification efforts, the overarching aim of the project is to develop a commercial base for date production, which Oman does not currently have. To be sure, it is a country of dates – family or community plots and small farms abound. Yet Oman has not had a large-scale commercially-oriented date industry since it collapsed in the early 1900s. This is what the MDP seeks to change. Under the $3.9 million project funded in 2018, UA involvement is confined to helping set up the Central Date Palm Laboratory at the farm in Sumail – a rural locale about 45-minutes' drive from Muscat, Oman. The lab includes facilities for tissue culturing and research on pests, disease, and the genetic composition of date varieties for commercial production. While the UA researchers are facilitating the set-up, the funding supports training to transfer the entire project to Omani scientists over a three-year period.[6] Not only is the project a major boon for university coffers, as UA's Vice Provost for Global Affairs and Dean of Global Campuses, Brent White, explained after the 2018 signing ceremony: "The University of Arizona has a longstanding relationship with our valued partners in the Middle East, particularly in the Gulf states. This project will enhance these relationships and, more importantly, spur scientific discovery that will positively impact Oman and people worldwide" (quoted in McGinley, 2019). This statement may diverge from the romantic constructions of the "Old World" of earlier eras, but the extractive logic – implicit and explicit – of institutional profit from such exchanges between Arizona and Arabia remains.

The story of establishing state power in the U.S. West is inextricably connected with the support of science and institutions of higher learning – specifically tied to agriculture, arid lands research, and desert farming. Uniting political actors, scientists, and farmers, colonising the Arizona drylands helped to which

[6] There is insufficient space to detail the full story here, but the laboratory project was originally envisioned in 2013 with direct government support, but after the collapse of oil prices in 2014 and subsequent cuts to Omani state budgets, it was cancelled and reconfigured through the country's military offset fund, Omani Authority for Partnership for Development (OAPFD). The fund originally set up the laboratory financing as an offset for Lockheed Martin, but their contract with the government fell through, so according to my interviews in January 2020, it is now financed by a Turkish military company. For more on offset programs, see Welt and Wilson, 1998.

produce the very idea of the "desert" as a naturalized site of intervention and a technopolitical zone that could in turn be operationalised as a site where scientists could travel and develop their scientific credentials. These were credentials that they then put to work in other parts of the world – then and now. The extraterritorial lines of connection stretching out from the Arizona desert in the experts that it produced are vast – and intensely political. The University of Arizona's early Agricultural Experiment Station projects, which grew out of the Hatch Act allocations, have had a tremendous impact on the state's development, as university staff and researchers sought to realise their visions of technoscientific agriculture in the drylands. While all these men were unequivocal supporters of the U.S. cause, their trajectories exemplify the unique relationship that was developing in the U.S. between science, the state, and its territorial expression, both at home and abroad. Specific as this case may be, it points to a need for more research on the intertwined development of states and sciences that is not just assessed comparatively – i.e. by looking for parallels across contexts – but jointly, as co-evolving processes that arise not in response to geographic facts, but by working with and through geography, borders, and environmental imaginaries – like the "desert."

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