AgTech in Arabia: 'spectacular forgetting' and the technopolitics of greening the desert

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Abstract

'AgTech' is the latest discourse about introducing new technologies to agricultural production. Researchers, corporations, and governments around the world are investing heavily in supporting its development. Abu Dhabi, the largest and wealthiest emirate in the UAE, has been among these supporters, recently announcing a massive scheme to support AgTech companies. Given the extreme temperatures and aridity of the Arabian Peninsula, several new start-ups have focused on 'controlled environment' facilities – hydroponics and aeroponics in various kinds of greenhouses. Despite the narrative of novelty touted by these companies, this is not the UAE's first foray with bringing ultra-modern or 'scientific' greenhouses to the Arabian Peninsula – a large University of Arizona project did so in Abu Dhabi from 1969-1974. Yet that project is largely forgotten today, including among today's new AgTech entrepreneurs. This article investigates why this is the case and, more generally, why the systematic failures of high-modernist, spectacular projects like those to green the desert are so routinely forgotten. In analyzing the story linking AgTech in Arabia 50 years ago and today, I show how 'spectacular forgetting' is related to the technopolitics of spectacle, but also rooted in geopolitical discourses and spatial imaginaries particular to each historical moment.

Keywords: spectacle; desert greening; AgTech; agriculture; Arabian Peninsula; United Arab Emirates

Résumé

«AgTech» est le dernier discours sur l'introduction de nouvelles technologies à la production agricole. Les chercheurs, les entreprises et les gouvernements du monde entier investissent massivement pour soutenir son développement. Abu Dhabi, l'émirat le plus grand et le plus riche des Émirats Arabes Unis, fait partie de ces partisans, annonçant récemment un programme massif de soutien aux entreprises AgTech. Compte tenu des températures extrêmes et de l'aridité de la péninsule arabique, plusieurs nouvelles start-ups se sont concentrées sur le développement d'installations à «environnement contrôlé» - hydroponie et aéroponie dans divers types de serres. Malgré le récit de nouveauté vanté par ces entreprises, ce n'est pas la première incursion des EAU à apporter des serres ultra-modernes ou "scientifiques" à la péninsule arabique - un grand projet de l'Université d'Arizona l'a fait à Abu Dhabi de 1969 à 1974. Pourtant, ce projet est largement oublié aujourd'hui, y compris parmi les nouveaux entrepreneurs AgTech d'aujourd'hui. Cet article cherche à savoir pourquoi c'est le cas et, plus généralement, pourquoi les échecs systématiques de projets spectaculaires de haut modernisme comme ceux de verdir le désert sont si systématiquement oubliés. En analysant l'histoire liant AgTech en Arabie il y a 50 ans et aujourd'hui, je montre comment "l'oubli spectaculaire" est lié à la technopolitique du spectacle, mais aussi ancré dans les discours géopolitiques et les imaginaires spatiaux propres à chaque moment historique.

Mots-clés: spectacle; verdissement du désert; AgTech; agriculture; Péninsule arabique; Emirats Arabes Unis

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Resumen

'AgTech' forma parte del nuevo discurso sobre la introducción de nuevas tecnologías en la producción agrícola, e investigadores, empresas y gobiernos de todo el mundo están invirtiendo grandes esfuerzos para apoyar su desarrollo. Abu Dhabi, el emirato más extenso y rico de los EAU, es uno de los promotores de AgTech, y recientemente ha anunciado un vasto plan para apoyar a las compañías AgTech. Debido a las temperaturas extremas y la aridez en la Península Arábiga, varias de las nuevas start-ups se han enfocado en las instalaciones de 'ambiente controlado' – cultivos hidropónicos y aeropónicos en diversos tipos de invernaderos. A pesar de una narrativa enfocada en lo novedoso de estas instalaciones promocionada por las compañías, ésta no es la primera incursión de invernaderos ultramodernos o 'científicos' en la península Arábiga – ya sucedió con un gran proyecto de la Universidad de Arizona en Abu Dhabi entre 1969 y 1974. Sin embargo, aquel proyecto ha sido completamente olvidado, incluso entre los nuevos empresarios de AgTech. Este artículo investiga el porqué de este olvido y, a modo más general, por qué los fracasos sistemáticos de los proyectos altamente modernos y espectaculares, como aquellos que persiguen reverdecer el desierto, son habitualmente olvidados. Analizando la historia que une AgTech con Arabia hace 50 años y hoy en día, expongo cómo el 'olvido espectacular' se relaciona con la tecnopolítica del espectáculo, y asimismo cómo está arraigado en los discursos geopolíticos y los imaginarios espaciales particulares de cada momento histórico.

Palabras clave: espectáculo; reverdecimiento del desierto; AgTech, agricultura, Península Arábiga, Emiratos Árabes Unidos.

1. Introduction

"Abu Dhabi rolls out Dh 1bn incentive scheme in support of agri-tech companies", proclaimed a headline in March 2019 in the Emirati state-controlled newspaper, *The National* (Townsend 2019). The initiative pledged 1 billion Dirhams – approximately US$272 million – to support establishing new agricultural technology companies in Abu Dhabi, which is the largest and wealthiest emirate in the United Arab Emirates (UAE) and the seat of the federal government. The 'AgTech' scheme was announced as part of the government's 3-year 'Ghadan 21' stimulus package focused on promoting the capital's competitiveness in four spheres: business and investment, society, knowledge and innovation, and liveability (Duncan 2019). Like the other emirates in the UAE, Abu Dhabi has fallen on financial hard times since the slump in oil prices beginning around 2015. In response, the government, led by Crown Prince Mohammed bin Zayed, has been promoting diverse schemes to increase the attractiveness of longer-term residence and investment in Abu Dhabi among middle- and upper-class workers and investors.

Meanwhile, start-up incubators in the UAE have been supporting AgTech projects, such as the Mohammed bin Rashid Innovation Fund's (MRIF) recent disbursement of US$1.5 million to Pure Harvest – a company that uses Dutch hydroponics technologies to produce greenhouse fruits and vegetables (MAGNiTT 2018). Indeed, it seems that high-tech farms are all the rage in the UAE, where other hydroponic farms include Elite Agro, Emirates Hydroponics, Madar Farms, and Badia Farms. The ostensible shock-factor of growing delicate produce in the desert is routinely underscored in the reporting on these new agricultural start-ups, with headlines boldly proclaiming: "This startup just raised $1.1 million to grow tomatoes in the UAE desert" (Puthuparampil 2016); "Pure Harvest raises $4.5 million to grow strawberries in the desert" (Chibber 2017); "UAE-based hydroponics startup looks to raise $4.5 million to farm in the desert" (Puthuparampil 2017); "Generation start-up: the mission to grow tasty produce in the desert" (Warner 2018); "How Abu Dhabi found a way to grow vegetables in 40-degree heat" (Charlton 2019).

In addition to the theme of surprise, which draws on cultural tropes about deserts as barren and treacherous places that only the most innovative, persistent, or visionary people might tame, the idea of *novelty* is another key element to the storylines about AgTech projects in the UAE. Pure Harvest, for example, was co-founded by a former private equity investor based in Silicon Valley, Sky Kurtz, and his Emirati business partner, Mahmoud Adi. They have pitched the company's high-tech operation to investors as part of a vision to establish the UAE's "first commercial-scale greenhouse to produce tomatoes" (Puthuparampil 2017). The image of novelty is no doubt essential to any start-up sales pitch. In this case, however, Pure Harvest's claim is simply not true. That honor (if mass-producing fresh tomatoes in the Emirati desert is to be considered an honor) rests

with the University of Arizona's Environmental Research Lab (ERL), which set up and ran a large-scale greenhouse project on Abu Dhabi's nearby Saadiyat Island from 1969 until 1974.

In pitching their project as a 'first,' the young entrepreneurs at Pure Harvest were not necessarily being disingenuous. In fact, in a conversation with a contact at the MRIF start-up incubator that was generously funding their work, I learned that they were completely unaware of the ERL project from nearly 50 years before.[2] I had a parallel conversation earlier that week in January 2019 with one of the founders of Madar Farms – a similar AgTech start-up using controlled environment agriculture, hydroponics, and vertical farming. Speaking at the company's impressive display during the World Future Energy Summit during Abu Dhabi Sustainability Week (Figure 1), this young founder also confirmed to me that he was unfamiliar with the history of the Arizona greenhouses in Abu Dhabi, indeed expressing his great surprise upon hearing of it.[3]

The more people I asked about the Arizona project, the more apparent it became that it had been largely forgotten. A handful of recent articles in one of the UAE's leading English-language newspapers, *The National*, have profiled the project (Dennehy 2019; Fortini 2018), but almost no one in the country's burgeoning AgTech sector seems to remember this history. After several months of fieldwork, I eventually encountered a few people who had heard about the project, but these were mostly murmurs about some 'old farmers' who had mentioned it. But no one seemed to know what led to its development, nor why it was ultimately shut down and dismantled in the mid-1970s.

Figure 1: Madar Farms display of its 'stackable' greenhouses made from converted shipping containers. Abu Dhabi Sustainability Week, January 2019. Source: Author

So, what did happen to University of Arizona's greenhouse project in Abu Dhabi? Why was it shut down? And what explains the fact that today's AgTech entrepreneurs know nothing of it? What are the political, social, and environmental consequences of this forgetting, and how might political ecologists theorize them more broadly? These are the questions at the center of this article, which draws on ethnographic observations at numerous events during the 2019 Abu Dhabi Sustainability Week, combined with interviews in Abu Dhabi and Dubai in January-February 2019, as well as others conducted by internet and in person in Arizona from

[2] Anonymous interview, January 2019.

[3] Anonymous interview, January 2019. For additional images from the World Future Energy Summit, see http://nataliekoch.com/galleries/uae-2019-adsw/

Spring through Fall 2019. While my ethnographic research inform this study, this article is more historic in its focus – drawing on archival research with sources held by the UAE National Archive, the UK National Archives accessed via the Arabian Gulf Digital Archive, the University of Arizona's Special Collections, and digital holdings of the Arizona Memory Project. Through systematic searches in the NewspaperArchive database and several supplementary databases as needed, I reviewed all articles about the Arizona project published in U.S. newspapers, periodicals, books, and academic journals in the 1960s, 1970s, and 1980s – approximately 65 individual texts in total. Finally, in addition to searching and monitoring all press about AgTech in the Gulf region since around 2013, I reviewed all *retrospective* publications about the Arizona project, including news stories and academic texts, consisting of about 20 sources in total.

In what follows, I first introduce my approach to spectacle, high-modernist agriculture, and the technopolitics of failure and forgetting. I then trace the general contours of the University of Arizona's greenhouse project in Abu Dhabi, and conclude by returning to the question of what this case can tell us about spectacle and AgTech initiatives in the Arabian Peninsula today. Bridging contemporary developments with the historical context, this article contributes to a small but growing body of research on the environmental history of the UAE, as well as extending research in political ecology to the Gulf region. Lastly, as a geographer, I heed Rebecca Lave's call for a deeper engagement between geography and science and technology studies (STS) to better "understand how science is wielded as a tool of appropriation" and "to expand our focus of analysis to include not just the application of science but also its production and circulation" (2012: 379-380). As political ecologists have so vividly illustrated, the story of science and its relation to what I will call 'spectacular forgetting' cannot be a disembodied one: actors with access to different social, financial, institutional, and scientific resources are the buyers and sellers of spectacle, and how they traffic in it makes this a political story.

2. Spectacular forgetting and the technopolitics of greening the desert

Abu Dhabi is situated in the Arabian Desert, with a coast along the Arab/Persian Gulf. Its inland territory is dominated by vast sand dunes, which form part of the *Rub' al Khali*, or Empty Quarter, made famous in the West by colonial explorers and traveler-writers, such as Bertram Thomas (1932), St. John Philby (1933), and Wilfred Thesiger (1959), among others. Receiving less than 100 mm (approx. 4 in.) of rain on average, but in parts even less, this desert is extremely arid. Gulf cities today rely almost exclusively on desalination technologies to provide for their water needs, while some natural springs and groundwater are used for agriculture in small oases around the Arabian Peninsula. The cost of water desalination, a highly energy-intensive process, means that the region is not economically or practically conducive to large-scale, commercial agriculture. Yet as a number of Gulf scholars have illustrated, this has been no barrier to grand visions to 'green' the region.[4] In addition to agriculture, afforestation and urban greening schemes have been common to the region – all of which have been predicated on a central goal of 'transforming' the Arabian Desert through introducing non-native plants, typically supported by water obtained through desalination. Indeed, desalination has been the condition of possibility for *all* contemporary development in the Gulf – serving as an essential technology facilitating both external and internal colonialism of the region.

Stretching well beyond desalination technologies, modern science in the desert has a long history, predictably connected to diverse colonial interventions. As Western scientists, explorers, and other 'agents of empire' encountered desert environments historically – whether Europeans overseas or Americans expanding state control westward – their near-uniform reaction to was to view them as both 'strange' and 'deficient' (Isenberg *et al.* 2019: 11). Colonial actors did not just seek to "understand or appreciate desert environments, but to control them, extend colonial authority over them and their inhabitants, and exploit the natural resources of them" (Isenberg *et al.* 2019: 12-13). The imperial impulse to exploit, master, or make productive a land that

[4] This work cannot be fully detailed here, but see especially Amery 2015; Elhadj 2004; El-Keblawy 2018; Elsheshtawy 2018; Günel 2019; Hightower 2015; Jones 2010, 2012; Joseph 2018; Joseph and Howarth 2015; Koch 2014, 2018a; Lambert 2014; Lambert and Bin Hashim 2017; Low 2019; MacLean 2017; McDonnell 2014; Ouis 2002; Woertz 2013.

does not readily conform to European experiences with agriculture is key to why deficiency is such a common trope in Western narratives about deserts:

> Few, if any, outsiders have been able to see their vast, arid stretches as complex, functioning nature in themselves; rather they have been viewed as symptoms of a nature that is debased and broken. The understanding of deserts as deficient has become deeply embedded in modern Western cultures. Because deserts – hot, arid and trackless – frustrated imperial endeavours, empires came to regard deserts as underrealised environments where climatic conditions were problems in need of solutions. (Isenberg *et al.* 2019: 13)

The image of the desert as a barren place "in need of solutions", especially in the Middle East, has a tremendously long history which cannot be detailed here (but see Davis 2016, 2019; Davis and Burke 2011; Reger 2019).

Just as varied as this history are the kinds of 'solutions' proposed for transforming arid lands. Large-scale interventions led by states and scientists have a more recent genealogy, rooted in what James C. Scott describes as high modernism – a "muscle-bound" confidence in scientific progress and a belief in the human ability to master 'nature' (1998: 4). In *Seeing like a state*, he shows how large, state-led projects routinely fail to deliver on their promises because they are predicated on a blind faith in technological solutions that underpins high modernist thinking. High modernism's optics of order and control are forever belied by on-the-ground realities, which defy its idealized vision of a world that might be tamed by rational thought, Science, and no small dose of autocratic systematization of the world. In Scott's discussion of agriculture, he also shows how Western approaches to modernist agricultural planning discounted local physical and cultural geographies of production in the colonial sites where they were applied – reducing productivity to a simplistic equation between farm inputs and yields (Scott 1998: 264). For him, the question is why the high-modernist model of scientific agriculture "has so often foundered in the Third World", and why, even in the face of failure, "the model has been pressed by colonial modernizers, independent states, and international agencies" (Scott 1998: 263). He and many other scholars have been preoccupied with these questions, and they have traced many failures of development projects around the world – hubristic and naively optimistic and everywhere in between.

Yet Scott's focus is more on the shortcomings of modernist thinking and less on the politics of *repetition* – that is, why these schemes are promoted over and over again. Although he is explicit in his focus on the 'Third World', examining how modernist thinking works in chronically poor countries and otherwise weak states, this implies a radically different political economic situation than strong states with the economic resources to prop up spectacular development schemes and keep the spectacle mill churning – such as those in Arabian Peninsula today. Likewise, among scholars writing about the world's diverse range of schemes to 'green' the desert or make the desert 'bloom', nearly all seek to explain why these projects fail. Diana Davis, for example, sets the agenda for her book, *The arid lands*, thus:

> Development efforts in the deserts and arid lands of the world have met with little success over the last century. Failed reforestation projects, irrigated and dryland agricultural schemes, and rangeland management perimeters dot the dry landscapes on every continent and in a great many individual countries. This book explains that a significant reason for many of these failures lies in the problematic notions of the desert that inform our understandings of arid lands and thus justify policy formulation. (Davis 2016: 1)

Numerous other scholars working on desert greening schemes come to a similar conclusion: problematic, inaccurate, or otherwise nonscientific notions about the 'desert' as an ecological *and* social space blind the hubristic planners of such projects and result in environmentally, financially, and culturally devastating losses (e.g. Akhter and Ormerod 2015; Alatout 2008; Barnes 2009, 2012b; Cameron 2018; DeBuys 2011; Evans 2019; George 1979; Heslop 2014; Koch 2015; Menga 2018; Mikhail 2011, 2012; Molle and Floch 2008; Pritchard 2012; Schmitt 2018; Sims 2014; Sneddon 2015; Tesdell 2015, 2017). In addition to the work on Gulf greening

projects noted above, the collective scholarship on failed development schemes in the desert cuts across political ecology's many disciplinary strands – from geography, anthropology, history, STS, and beyond. It has made critical interventions that reject the utopian narratives of high-modernist planners who promise to transform beautiful and inherently valuable desert environments into something *other* – a Western ideal of abundant vegetation and water-intensive agriculture, which are so often doomed to failure.

While it is important to ask *why* such projects fail, I want to linger on the question of why we *forget* that they fail. This is important because a strategic amnesia or forgetfulness seems to be built into spectacular, high-modernist projects that helps to explain their recursiveness over time and across space. Scholars have amply shown how such interventions cannot be understood apart from the deeply political networks of Western science and expertise that give rise to and validate the visions they articulate – a staying power that is further entrenched when narrated and institutionalized through structures of colonialism and later, the "anti-politics machine" (Ferguson 1990) of global development discourse. Yet returning to the case study at hand, the curious continuity between the UAE's AgTech projects today and its experiments in the late 1960s and early 1970s cannot be explained as another iteration of some internationally hegemonic notion of development, just expressed through the contemporary language of modernity and technofetishism. There is something more at play that explains this circularity and, more generally, the amnesia upon which the technofetishism and spectacle of greening the desert is built. This article explores two key factors that might suggest some answers.

First, is *the role of spectacle as a political technology* in these desert greening projects. As I have detailed in my recent book, *The geopolitics of spectacle* (Koch 2018b), spectacle operates through stark contrasts with an unspectacular Other, such as the sight of something lush or green in an arid desert landscape. And as Glenn Stone (2018: 660) has recently argued in this journal, because "agriculture is normally a highly visible transformation of the landscape", its uniquely "visual heuristics" lends itself to spectacle. Spectacle has a particular point-based spatiality and temporality that, when successful, focalizes attention in a particular place or moment in time. Spectacle often works through the logic of experimentation or miniaturization, creating "a small, relatively self-contained, utopian space where high-modernist aspirations might more nearly be realized" (Scott 1998: 257). By captivating the gaze, the failures or the illogic of a spectacular project are/is cast aside and strategically ignored. What might be called 'spectacular forgetting' is thus quite different from other forms of forgetting violence or injustice, such as those that Paul Connerton (2008) and other scholars of memory analyze as repressive erasure, prescriptive forgetting, annulment, or humiliated silence. Unlike the forgetting or silencing of social wrongs, spectacle's forgetting is diversionary – it is predicated on the future-oriented *telos* of high modernism. Rob Nixon describes this temporal aspect in discussing the "insidious workings of slow violence [which] derive largely from the unequal attention given to spectacular and unspectacular time" (2011: 6). The special temporality of spectacle is central to its curious recurrence in the face of repeated failure.

A second factor behind such recurrences relates to *the narrative ties that bind technopolitical networks* of scientists and politicians. Albeit differently configured in the 1960s/70s and today, these actors work in tandem by drawing on specific geopolitical identity narratives of cooperation and nationalist narratives of 'modernity.' The flexible storylines about progress, development, national pride, and international influence facilitate diverse actors' cooperation around spectacular projects – as well as the forgetting of high modernism's systematic failures. In addition to these identity narratives, I emphasize the central role of *desert imaginaries* in connecting these networks, as well as their media partners, which reaffirm the seductive pull of high modernist imagery surrounding AgTech in Arabia and greening the desert more generally. The recursiveness of such visions is possible, I argue, through the strategic forgettings of spectacle as a global grammar, but are brought to life in particular places through the agency of positioned actors working within the constraints of their geopolitical moment – drawing upon the contextually-specific discursive and material resources at their disposal. Tropes and visions of the *desert* are a key part of this story because they are always political. Individual actors craft their own narratives about the desert, but they fit them into a broader grammar or set of spatial imaginaries about arid lands, which are culturally and socially defined (Davis 2016).

As Sheila Jasanoff (2015: 17) forcefully reminds us, "it is still humans and their collectives who can imagine a world" – a world that is thus transformed into a site that might be governed through science and technology. Of course, spatial imaginaries are relative and constantly in flux (Tuan 1975, 1977). But they can take general forms, such as in the Biblical visions of deserts as spaces of destitution and sacrifice, or in

Euroamerican colonial imaginaries as threatening landscapes to be conquered by vigorous, white male explorers. Spatial imaginaries are especially important for social studies of science because "science is modernity's ultimate traveler, its findings accepted everywhere as universal" (Jasanoff 2015: 22). Or such is its aspirational fiction: the scientists, engineers, and statesmen who seek to apply their technofetishized visions of progress in experimenting around the world are not actually imagining *tabulae rasae*. Rather, for them, the spectacle of their modernizing work (bringing 'cutting edge' technological advances to far-off places) gains power when calling upon and crafting narratives of particular places: the rugged frontier, the unnavigable terrain, the inclement, the oppositional, the harrowing, the exotic, the uncivilized. All these traits add to the drama and impressiveness of their achievements. As we will see with the case of AgTech in Arabia and its predecessors, the idea of the desert provides precisely this foil. But since spatial imaginaries are not 'natural,' it is a story that scientists and others seeking to evoke the awe and wonder of some alleged feat in the desert must tell again and again.

3. 'Gardens in the desert': historicizing the spectacle of AgTech in Arabia

In early 1969, news broke that the University of Arizona's (UA) Environmental Research Laboratory was being commissioned to build a cutting-edge combined greenhouse-desalination facility in Abu Dhabi, which researchers had piloted in the Mexican town, Puerto Peñasco. It was announced in a front-page story in the *Tucson Daily Citizen*, accompanied by an image proclaiming: "This will turn desert into a garden" (Crone 1969: 25) (Figure 2). Another article by *Los Angeles Times* reporter Charles Hillinger (1969), titled "Gardens in the desert: Sheik looks to the future", offers the standard origin story of the project thus:

> An Arabian sultan, the Sheik of Abu Dhabi, believes the answer to one of his most perplexing problems lies on the beach of Puerto Peñasco, a remote Mexican fishing village. What particularly annoys Sheik Zaid Bin Sultan Al-Nahyan, ruler of a postage-stamp sized Persian Gulf Principality, is the price of fresh vegetables in his oil-rich country. Abu Dhabians pay $1.50 a pound for vegetables flown to their sand hills from Lebanon. The Sheik is fascinated with an inexpensive, revolutionary process of growing food on coastal desert lands developed in recent months in the Mexican village on the northeastern shores of the Gulf of California. It's a complicated system, simple to operate, that utilizes distilled sea water, polyethylene 'greenhouses,' waste energy from small diesel engines and 'scrubbed' smog (Carbon Dioxide).
>
> When the Shiek heard about the successful experiment in Puerto Penasco he dashed off a check for $3.16 million to build a similar project in his desert kingdom large enough to keep his 50,000 subjects in fresh vegetables year round. The check went to the University of Arizona Environmental Research Laboratory here – inventors of the combined system that provides cheap power, water and food on desert coastal lands. Carl N. Hodges, 32, director of the laboratory, on a recent world trip to places potentially suitable for the process, visited Abu Dhabi. Hodges said it was possible for Abu Dhabi to produce two million pounds of high-quality vegetables a year on its sand dunes at a cost of less than 10 cents a pound. (Hillinger 1969: 22)

Hillinger's article goes on to characterize Abu Dhabi as "the richest nation on earth per capita" thanks to a "fantastic oil boom." Then one of the Trucial States of Eastern Arabia under British protection, Abu Dhabi was not an independent state – but it was about to become the leading emirate of the UAE, with Sheikh Zayed recognized as the country's 'founding father' a few years later in 1971.

As another article in the *San Francisco Chronicle* explained, the "remote Sheikhdom of Abu Dhabi – one of the virtually unknown trucial states" was being transformed by Sheikh Zayed, who was intent on "speeding his nation into the world of Now. A decade ago Abu Dhabi had nothing – sand, a dusty port, a couple of inland oases where dates and a few vegetables grew. Now there is oil, vast reservoirs of it, and oil royalties are pouring into the Sheikhdom, spurring schools, roads, and a modern style" (Perlman 1970: 10) – and, the author adds, a UA-built "self-powered food factory." In fact, the *Chronicle*'s article – and the news itself – was deemed significant enough for the U.S. Department of State to send it to all of the Science Attachés and Science

Officers at Embassies in the Middle East, Northern Africa, and South Asia (see Figure 3).[5] The U.S. government was not a passive observer of the UA project in Abu Dhabi, but an active supporter – albeit a tepid one at first and a resistant one later in the life of the project.

Tucson Daily Citizen

THURSDAY, FEBRUARY 27, 1969 PAGE 25 ★

Sports News

Food, Water, Power

UA Team To Build Arabian Plant

This Will Turn Desert Into A Garden

Mexican Unit Will Be Model

By NYLA CRONE
Citizen Staff Writer

Green vegetables soon will emerge from the beach sands of the Arabian Peninsula desert — the pioneer work of University of Arizona scientists.

They will build in the postage-stamp Shaikhdom of Abu Dhabi on the Persian Gulf an integrated Desalting plant to produce food, power and water.

The $3 million project will be a larger scale version of the one designed by Carl N. Hodges, supervisor of the UA Environmental Research Lab, that has been in operation at Puerto Penasco, Son., for the past year and a half.

But the Middle East facility will have perhaps 10 times the capacity of that in Mexico.

Dr. A. Richard Kassander, director of the Institute of Atmospheric Physics, of which the lab is a part, said today that the Abu Dhabi project will be financed by a $3.16 million, three-year grant from the ruler of the tiny state, Shaikh Zaid Bin Sultan Al-Nahyan.

The heart of the desalting plant is a simple diesel-electric engine which produces fresh water and lush vegetable growth in a controlled environment within inflated plastic structures.

With the diesel engine the scientists have combined a heat exchanger which works in effect

struck there in 1961, Abu Dhabi now is the richest state in the world on the basis of per capita income. One of several Trucial States located along the western coast of the Persian Gulf — now known as the Arabian Gulf — the sandy country is about the size of Pima County.

The city of Abu Dhabi is on an island separated by a shallow estuary from the rest of the country. It has received all its water through pipeline from an oasis about 100 miles away.

The island site of the desalting plant is Jaziraf as Sa 'Diyat (the Isle of Happiness), about one and one-half miles from the island on which Abu Dhabi City is located.

"A dozen fishermen and their camels live on the small island at present," said Hodges.

Dr. James J. Riley of the Environmental Research Lab said that some of the oil companies did a study and found out that Abu Dhabians like much the same vegetables we do.

Riley, a hydrologist, will be resident director of the project. Work includes a training program for key Abu Dhabi people who will be connected with the facility and its operation.

Present training includes tape recorded lectures in English and Arabic to brief Abu Dhabians on the project. Within a few months two people from there will be

Police Clip Wings Of Head 'Angel'

LOS ANGELES (UPI) — The national president of the outlaw Hell's Angels motorcycle club was arrested Monday night and booked on suspicion of carrying a concealed weapon and possession of heroin.

Strike Halts All Flights By Airline

WASHINGTON (UPI) — American Airlines halted all operations today because of a strike by mechanics and other workers. Hundreds of flights were cancelled across the coun-

ESHKOL MOURNED

Mrs. Meir Backed For Israeli Chief

JERUSALEM (UPI) — Thousands of Israelis, young and old, filed past the bier of levi Eshkol today to pay their respects to the premier who guided an Is-

Secretary Robert H. Finch of the Department of Health, Education and Welfare, who left Washington early yesterday.

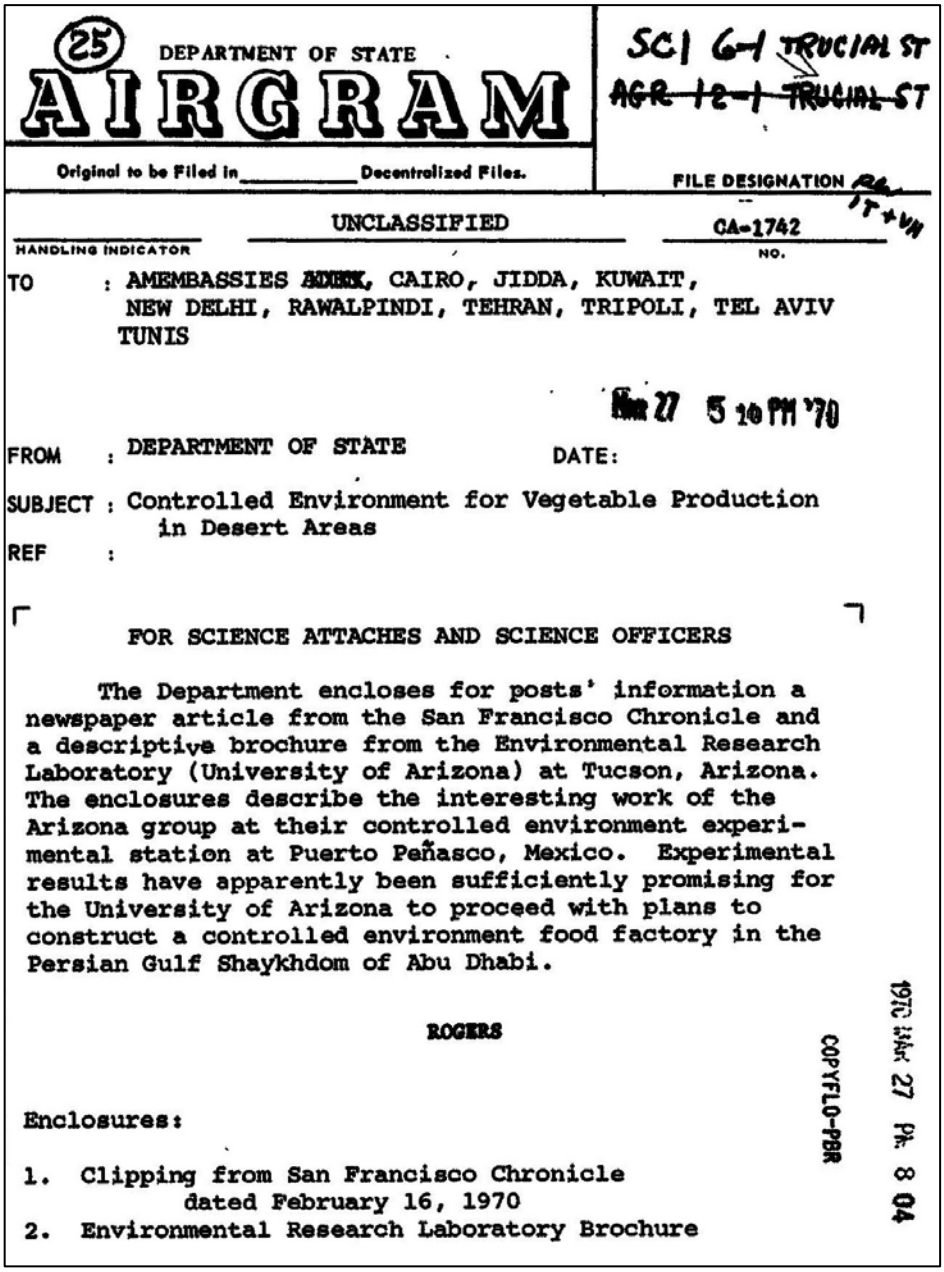
Shooting erupted today be-

Figure 2: *Tucson Daily Citizen* breaking the news about the ERL project in Abu Dhabi. Source: Crone, 1969: 25.

As Hillinger's article suggests, however, the main U.S. actor behind the UA initiative was Carl N. Hodges – the Environmental Research Laboratory's (ERL) director and an evangelist for making deserts 'bloom' through hi-tech solutions to climate and resource limitations. The trope of making deserts bloom pervaded reporting on Hodges' work with the ERL, including the first national media profile of him with the caption, "Young scientist hopes to make the deserts bloom" (Crone 1970: 27). Hodges was himself wont to use the expression (see, e.g. Negri 1987: 15), even though he claimed to despise it, "partly because it is a cliché and in part because it is, in many specific cases, plainly improbable" (Crone 1970: 27). The cliché nonetheless served his purposes and it was central to the 1967 *Time Magazine* article, which got him on Sheikh Zayed's radar. This short article profiled the ERL's Puerto Peñasco greenhouse/desalting project and cast the 32-year-old Hodges as a 'visionary':

[5] UAE NARA 2937, Department of State Airgram: Controlled Environment for Vegetable Production in Desert Areas, 26 March 1970.

Visionaries have long dreamed of using sea water to make these deserts bloom, but University of Arizona Scientist Carl Hodges is actually doing something about it. And not by means of futuristic and costly nuclear-powered desalination plants, but by efficient use of simple diesel-electric engines like those that now provide power to remote communities all over the world. A pilot project on Mexico's Gulf of California is already accomplishing in miniature what Hodges hopes to achieve on a global scale. (*Time* 1967: 32)



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DEPARTMENT OF STATE

AIRGRAM

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FILE DESIGNATION AGR 12-1 TRUCIAL ST

UNCLASSIFIED — HANDLING INDICATOR

CA-1742 — NO.

TO : AMEMBASSIES ADEN, CAIRO, JIDDA, KUWAIT, NEW DELHI, RAWALPINDI, TEHRAN, TRIPOLI, TEL AVIV TUNIS

Mar 27 5 10 PM '70

FROM : DEPARTMENT OF STATE DATE:

SUBJECT : Controlled Environment for Vegetable Production in Desert Areas

REF :

FOR SCIENCE ATTACHES AND SCIENCE OFFICERS

The Department encloses for posts' information a newspaper article from the San Francisco Chronicle and a descriptive brochure from the Environmental Research Laboratory (University of Arizona) at Tucson, Arizona. The enclosures describe the interesting work of the Arizona group at their controlled environment experimental station at Puerto Peñasco, Mexico. Experimental results have apparently been sufficiently promising for the University of Arizona to proceed with plans to construct a controlled environment food factory in the Persian Gulf Shaykhdom of Abu Dhabi.

ROGERS

COPYFLO-PBR

1970 Mar 27 PM 8 04

Enclosures:

1. Clipping from San Francisco Chronicle dated February 16, 1970
2. Environmental Research Laboratory Brochure

Figure 3: Department of State Airgram: Controlled Environment for Vegetable Production in Desert Areas, 26 March 1970. Source: UAE National Archive.

One of Sheikh Zayed's aides allegedly got hold of this article and upon sharing it with the leader, "he became so excited at the possibility of having fresh vegetables grown in his country, which has an annual rainfall of 1 inch, that he invited the director of the research station, Carl N. Hodges, to Abu Dhabi" (Bazell 1971: 989). Negotiations ensued, and per the first article quoted above, Zayed "dashed off a check" to develop the same project on Saadiyat – an island just adjacent to Abu Dhabi Island, home to the emirate's main urban center. Hodges clearly relished (and probably stoked) the hyperbolic media attention given to the ERL's new undertaking in the Arabian Peninsula. For him, the greenhouse represented no less than a "cornucopian transformation" of a "parched islet off the Arabian mainland" (Hodges 1975: 35):

> There, desalted seawater, distilled with waste heat captured from generators, is used to irrigate vegetables inside plastic-skinned greenhouses in which the microclimate can be regulated. All of this may seem reminiscent of *Dune*, a 1967 Frank Herbert novel that ecology buffs have evangelized as almost a new *Book of Revelations*. In *Dune* the locale is a waterless planet bereft of any verdure save that in an indoor garden. In Abu Dhabi the nonfictional indoor gardens promote fertility where dust storms, heat, and aridity preclude ordinary agriculture, and the low, sparse shrubs barely sustain a few browsing camels. (Hodges 1975: 35)

Sensationalism aside, it is true that beyond some date farming and small-scale oasis production, the region did not have a strong agricultural economy prior to colonial involvement. This was largely due to climatic, labor, and technological limitations at the time, but also, colonial officials believed, because land and resources had not been surveyed and transformed through actionable information for their exploitation. Land and water surveys were thus some of the first undertakings of British officials in the mid-1900s.

But the UA project in Abu Dhabi announced in 1969 was not the first effort to introduce 'scientific' agriculture to the land that would eventually become Emirati territory. Rather, the first concerted effort to promote commercial farming came in 1955, when the British initiated an Agricultural Trials Station in Digdagga, located in the emirate of Ras al-Khaimah. As MacLean (2017: 30) argues, British authorities saw the project as a way to "win hearts and minds" in the Trucial States following the Saudi occupation at Buraimi from 1952-1954, during which the Saudis criticized the British for failing to promote local development. Since the British empire had a well-established pattern of promoting 'scientific' agriculture to 'modernize' their territorial holdings (Hodge 2007), it was a logical project to pursue after ousting the Saudis from Buraimi. The Ras al-Khaimah project could easily exemplify British benevolence, but was not so expensive as to upset officials in the increasingly cost-conscious Treasury. The Digdagga Station continued its work into the 1960s, testing commercially-viable products for local markets and educating local farmers in 'scientific' cultivation methods, and later, working to develop bovine dairy farming (MacLean 2017; Zacharias 2013, 2017).

The impact of the Digdagga project was quite limited, however, and assessments of Emirati agriculture in the 1960s and 1970s were generally bleak (Bowen-Jones 1980; Bowen-Jones and Dutton 1983; El Mallakh 1970, 1981). Nonetheless, by the mid-1960s, dramatic changes began when Sheikh Zayed bin Sultan Al Nahyan came to power as the new leader of Abu Dhabi. In 1966, Zayed deposed his elder brother, Sheikh Shakhbut, allegedly because of his refusal to use revenue from oil extraction (discovered in 1958) for the territory's development. In addition to positioning himself as a generous and benevolent figure keen to advance the cause of his people, Zayed was a vocal advocate of greening the Arabian desert through agriculture, afforestation schemes, and a range of other initiatives (Bowen-Jones 1980; Ouis 2002). Greening the desert was a source of Zayed's legitimacy, in no small part because of the spectacle of conquering 'nature' and 'rolling back the desert' that allowed him to evince his benevolent care for his people and the land. "The greening project", Ouis explains, became central to Emirati national identity narratives, as well as "the legitimization of power for the ruling sheikhs and the political system of paternalism that has come to be termed Zayedism" (2002: 338).

The spectacle of greening the Emirates, as a trope with political and cultural pull, only works through a particular narrative about the desert. In line with Western constructions of desert landscapes as somehow inferior or deficient, Zayed's vision hinged on a "cultural valuation of the green environment as better than the 'natural' dry desert" (Ouis 2002: 339). In this negative framing, the desert's barrenness was thus approached as a problem that required intervention from the benevolent leader and "it was only through the emirate's

intervention that the land's potential could be realized" (Hightower 2015: 2). Using the political technology of spectacle, Zayed and his allies could readily broadcast his paternalism through his greening projects and, in so doing, reinforce the narratives of largesse: "By making the desert bloom or saving extinct species, providing both a message of generosity and a visual reminder of its power. Developing the environment provided the government with a way to reimagine its place in history and in its citizens' lives" (Hightower 2015: 2-3). But Zayed's messages did not circulate on their own: individuals had to pick them up and broadcast them. Who, then, were his allies in this effort? Arguably there were many, but among these was the ERL director, Carl N. Hodges, who lobbied intensively on Zayed's behalf – not just for financial support for the greenhouse project from the Rockefeller Foundation, University of Arizona officials, and even the U.S. State Department, but also in his media campaigning about it.[6]

Agricultural experimentation and model farms had long been fixtures of British and French colonial development projects in the Middle East and Northern Africa (Barnes 2009; Beckert 2014; Davis and Burke 2011; Hodge 2007; Joseph 2015; Joseph and Howarth 2015; MacLean 2017; Pritchard 2012; Scott 1998), but similar U.S. projects were far more limited in scope as the country's imperial reach spread beyond its shores. The first overseas U.S. agricultural research station was the Jewish Agricultural Experiment Station near Haifa, which only lasted for five years until the beginning of World War I (Tesdell 2017: 48). Several other projects followed, but U.S. efforts to promote 'scientific' agriculture internationally only started to pick up more seriously after World War II, when they were folded into broader visions of American-defined modernization – itself envisioned as "an altruistic solution to some of the Cold War's most vexing problems" (Latham 2011: 4). Unlike the European agents of empire, U.S. modernizers relied more heavily on partners in academia, philanthropic foundations, and nongovernment organizations. Many American academics came to internalize this ideology and/or position themselves and their careers in service of the Cold War agenda, heeding Harold Lasswell's (1951) famous call for social scientists "to forge new links in response to the Cold War emergency" (Latham 2011: 36).[7] It is within this context that Carl Hodges and his partners at the University of Arizona were working when the opportunity arose to take their agricultural innovations to Abu Dhabi.

4. 'More show biz than science'? Selling spectacle and modernity in the UAE

In the late 1960s, Hodges and Zayed were also operating within a context of unprecedented technofetishism surrounding the Green Revolution. In addition to indexing Emirati modernity and "expressions of the young nation's independence and a break from its past as a British protectorate" (Ouis 2002: 340), new agricultural technologies were heralded as silver-bullet solutions to famine, poverty, and, this being a U.S.-led discourse, the threat of communist revolution:

> The Green Revolution's central focus on raising productivity allowed modernizers to recast complex social problems in an appealingly simple way. Setting aside questions about the structure of the global agricultural economy, the distribution of food within countries and regions, and the dilemmas caused by inequalities in wealth and consumption, U.S. experts focused instead on the discrete technical problem of increasing the yield of a given crop per unit of area planted. If that problem could be solved, advocates of the Green Revolution believed, rapid, comprehensive transformations would naturally follow. Thus plant breeding and the pursuit of 'miracle seeds' were envisioned as especially potent social levers. (Latham 2011: 110)

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[6] Two other Arizona researchers, James J. Riley and Merle Jensen, were also important actors in realizing the project, but there is insufficient space to detail their involvement here. Also falling outside of the scope of this article are the tensions and controversies around the funding sources, which I explore elsewhere. Documentation of these controversies is available only in certain archives (the US and UAE National Archives, as well as the University of Arizona's Office of Public Records), but for a rare example of public exposure on one aspect of the (many) financial irregularities of the Abu Dhabi project, see Thomas (1969b).

[7] A great deal of work in STS has focused on research communities and the technopolitics of the Cold War, which cannot be detailed here, but see especially Adas 2006; Aronova and Turchetti 2016; Farish 2010 and Hecht and Edwards 2010. Likewise, a wider literature on environmental history, the Cold War, and modernization ideology cannot be surveyed here, but for a review essay, see Robertson (2016).

The utopian ideals of a technology-driven Green Revolution circulated widely, especially as they were fused with neo-Malthusian anxieties about over-population and unrest in the decolonizing world (Dalby 2009; Latham 2011). In addition to organizations like the Ford and Rockefeller Foundations, diverse international institutions including the UN Food and Agriculture Organization (FAO) began to promote their adoption globally. The University of Arizona's project in Abu Dhabi fit neatly into the positive, future-oriented visions of solutions to the challenges of an uncertain and rapidly-changing world order. The spectacle of the project was enticing, therefore, because it was a concrete manifestation of the promise that it was imagined to hold for a brave new world.

Just like the reporting on new AgTech projects in the UAE cited at the outset of this article, newspaper coverage of the Arizona project in the 1960s and 1970s pulled on the same threads of shock and wonderment, with headlines underscoring the element of surprise in both the technological innovation *and* the extraordinary reach of the University of Arizona to the furthest reaches of Arabia: "It can be done in a sand dune" (*Phoenix Arizona Republic* 1970), "Desert food factories" (Hodges 1975); "From the big greenhouse in Tucson to the sands of Abu Dhabi" (Cook 1969), "Arid land agriculture: Shaikh up in Arizona research" (Bazell 1971), "UA sets Abu Dhabi table" (Finkelstein 1972). Figures 4 and 5 illustrate the visual presentation of these articles, including one *Phoenix Arizona Republic* headline, "Lush fruit growing in sand signals wasteland conquest" (Thomas 1969a), and another array of photographs with the theme "Arizona born concepts transform desert wasteland" in *Arizona Highways* (1975). Part of a special issue on solar technology, the *Arizona Highways* captions mischaracterize the Abu Dhabi project as using solar technology (it used diesel engines), but nonetheless illustrate how the very same tropes about the UA researchers 'conquering' or 'transforming' the Arabian desert 'wasteland' into a marvelous site for the cultivation of delicate fruits and vegetables.

The contemporary reporting on the Arizona project was overwhelmingly laudatory. Hodges relished the splashy news coverage and he eagerly harnessed the media machine to advance his own career – and his insatiable ego. Overall, he would not tolerate critique: when one reporter sought dissenting opinions about his desalting technologies, which many deemed far too expensive to be deemed successful, Hodges characterized the judgment as "offensive" (Negri 1987: 15). A few murmurs of the unreasonable cost of the project did surface in the media, though, including one article in the London *Times.* Running under the title, "The desert yields rich food crop—at a price", it cited the millions of dollars already invested and described the project as "a typical example of reversing nature and proving that the desert can be made fertile—but at considerable cost" (Frenchman 1971). In a later academic evaluation of the project, Bowen-Jones and Dutton highlight the fact that it showed "virtually anything can be produced if cost is ignored" (1983: 158). They also underscore the fact that "the key inputs of energy, capital and water – since this comes from desalination plants – are oil based" (p. 156).

That is, if the greenhouse project was being framed by Hodges and others as a remedy to the Arabian Peninsula's problem encapsulated by the refrain, 'we can't eat oil,' it was actually entrenching the region's reliance on oil by using it to generate water and crops at great cost. Indeed, as one reporter noted in an early story about the ERL's mission in Abu Dhabi: "Actually, all this horticulture is more show biz than science right now. But the ideas of 'controlled environment' and a man-made humidity which makes things grow where they normally wouldn't are what the laboratory is all about" (Cook 1969). The 'show biz' spin that Hodges promoted was, in short, a key part of the narrative fiction about the project. And just as Zayed was interested in cultivating the spectacle of the hi-tech greenhouse and the image of modernity surrounding his broader campaign to green the Emirati desert, Hodges worked right alongside him to produce the spectacle and use it to advance his own career and construct himself as a precocious visionary working at the cutting edge of science.

The stream of news reports referencing the ERL's project in Abu Dhabi continued into the late 1970s, but University of Arizona ended its involvement with the project in 1974. Eventually, the greenhouses were dismantled and sent to Abu Dhabi's interior town of Al-Ain, while the diesel-powered desalination components were relocated to Abu Dhabi island (Hightower 2015: 12). There is no official account of what caused the initiative's demise, but interviews and archival research suggest that a handful of factors were at play. Partly, it was an issue of funding. The patchy archival record points to serious disagreements between Hodges and Sheikh Zayed, University of Arizona officials, and the U.S. Department of State around securing additional funding for the project. Falling outside the scope of this article, but which I explore elsewhere, Hodges struggled to

secure additional funding from all three of these sources and he appears to have made some enemies in the process.[8] He was trying to navigate some tricky relations at a time of heightened geopolitical significance, as Sheikh Zayed was on the cusp of become the leader of a new, independent state with the British withdrawal from the Gulf in 1971. Ultimately, though, as one State Department telegram neatly summed up, Hodges was "operating somewhat beyond his depth." As useful as his scientific credentials were in other realms, the Arizona researcher came up against the limits of his political influence – something that allegedly left Zayed "miffed."[9]

CITY

22 The Arizona Republic
Phoenix, Fri., March 28, 1969

Lush strawberries from beach sand

Republic
photo-feature
By
Bob Thomas

Rows of polyethylene tents cover food growing experiments by University of Arizona at Puerto Penasco plant on the Gulf of California

Lush fruit growing in sand signals wasteland conquest

PUERTO PENASCO, Sonora — The sun and the sand were hot and the sea was that improbable blue of a picture.

Yet the minds of two men kneeling in the beach sand a few hundred feet from the gentle embers were not on fun and fish.

They were totally absorbed in several score of healthy green strawberry plants, laden with some of the biggest, most luscious fruit this side of an American supermarket.

The plants were growing in ordinary beach sand, slightly moistened with

A few years ago geologists found an ocean of oil beneath the barren sands of Abu Dhabi. The capital city, also called Abu Dhabi, is situated on an island, linked to the mainland by a new $2 million bridge.

About a mile and half away, on the island of Jaziat as Sa'Diyat (Isle of happiness), the university's environmental research laboratory will build about 10 acres of vegetable-growing greenhouses coupled with a 64,000-gallon-per-day desalting plant.

The basic components will be manufactured in Tucson and shipped to Abu Dhabi to be erected by a subcontractor. By 1971 the plant should be ready to be

diesels, including carbon monoxide, are "scrubbed" with sea water to cleanse them of poisonous fumes and the re-maining carbon dioxide is pumped to the inflated polyethylene greenhouses.

While desalted water can be used, the Puerto Penasco facility performs its own desalinization process in the greenhouses. Salt water, draining though the beach sand, is pumped up and sprayed into a box containing an electric blower. The moist vapor is blown upwards to condense into fresh water on the plastic tops and sides of the greenhouse. The water drains downward and is collected and piped to the individual plants.

Because little of the water is lost by

generating plant composed of five diesel turbines, a two-module 64,000-gallon-per-day desalting plant, and the 500,000 square foot, or 48 greenhouses, vegetable farm.

Experiments at Puerto Penasco are giving technicians the data they need on just what varieties of vegetables grow best in the greenhouses and which types of nutrients are needed to feed them.

Humidity inside the greenhouses hovers at 90 per cent and to those who are not used to the environment it causes immediate and profuse perspiration.

For some plants such as strawberries and tomatoes the sun's rays through the

Figure 4: *Phoenix Arizona Republic* story on the ERL project. Source: Thomas, 1969a: 36.

Meanwhile, from the University of Arizona side, administrators were increasingly frustrated by regular disagreements about funding, as well as difficulties with retaining university personnel involved in the project. For Arizona staff sent to Saadiyat in the early 1970s, it was perceived as a hardship post and few wanted to stay long.[10] Furthermore, Hodges was increasingly agitated by what he saw as the lack of Emirati commitment to *research*. In a 1973 letter to Sheikh Hadif bin Humaid of the Abu Dhabi Government's Sadiyat Committee, he cites the fact that after a 1972 fire at the greenhouse facility's research office, the Emirati partners had still not rebuilt it as promised. He also was incensed by their insistence on retaining one important scientist, Merle Jensen, on site, writing:

[8] UAE NARA 2631, Department of State Memorandum of Conversation: Power/Water/Food Project in Abu Dhabi, 19 August 1970; UAE NARA 2621, Letter from Carl Hodges to Senator Paul J. Fannon, 28 September 1970; UAE NARA 2937, Department of State Airgram: Abu Dhabi Arid Lands Research Center, University of Arizona Project, 3 December 1970.

[9] UAE NARA 2937, Department of State Telegram: Abu Dhabi Arid Lands Research Center, 10 December 1970.

[10] Anonymous interviews, July, September, November 2019.

> I am not at all pleased with the comments to the effect that, if Dr. Jensen does not remain in Abu Dhabi in 1974, there will be no Technical Assistance Agreement with the University of Arizona. I hope that these comments have been misinterpreted and that is not the Committee's intention. It is my hope that, from your visit here, you realize that the University of Arizona is composed of a large number of talented people in many fields, and to place conditions on the Technical Assistance Agreement in terms of the Government's specifying one individual is totally unacceptable to the University.

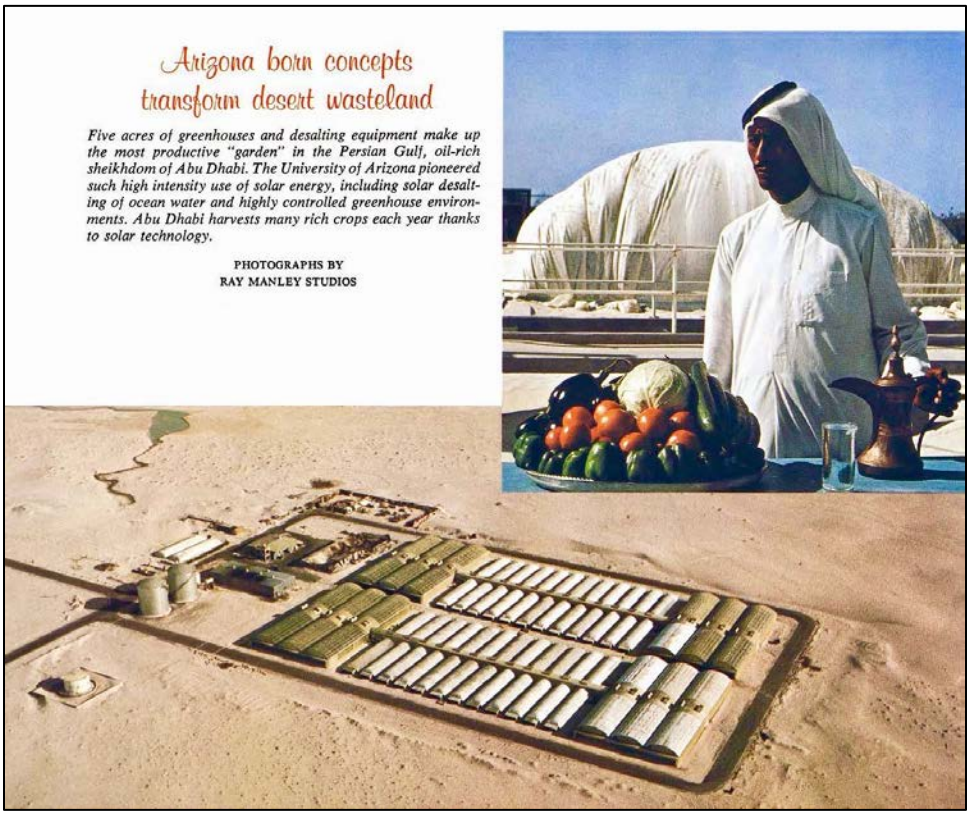

Figure 5: Images accompanying an *Arizona Highways* story about University of Arizona research projects. Source: *Arizona Highways*, 1975: 30.

Hodges then proceeded to explain that, as much as he wanted the University of Arizona to remain in Abu Dhabi, "it is now time for the Government to make a fundamental decision as to whether they wish the Sadiyat project to run strictly as a vegetable production facility or if they wish a continued cooperative research effort between the Government of Abu Dhabi and the University of Arizona." He continued:

> If the Government wishes to deemphasize research and development and simply operate Sadiyat during 1974 for the production of vegetables, the University of Arizona should no longer be involved with the Technical Assistance Agreement. We have a great number of requests for research and development projects to be directed by our staff, and our talents can be more effectively utilized as research scientists than as simply vegetable production advisors. If, on the other hand, the Government of Abu Dhabi wishes to carry on the outstanding research and development effort they have initiated on Sadiyat, the University wants to be part of that effort.[11]

[11] University of Arizona Office of Public Records, Schaefer Presidential Records: Letter from Hodges to Sheikh Hadif bin Humaid, 14 September 1973.

In essence, Hodges did not feel that his team of scientists were actually doing enough science to justify their continued work at the Arizona-run greenhouses. Hodges was known for his temper and the tone he strikes in this letter is telling – trying to perform some gestures of respect, but ultimately belying his deep anger that his credentialed researchers should be treated as mere 'vegetable production advisors.' Ironically, the show-biz master himself was confounded by the Emirati partners' interest in a different kind of show-biz – here instead oriented around harnessing the legitimacy that the University of Arizona partnership brought without following through on the substantive, research-focused commitments it entailed. They were, in short, largely interested in the spectacle.

Yet the calculus of the spectacle in Abu Dhabi began to change by the mid-1970s, as well. And another, perhaps larger reason for ending the UA greenhouse project – and more specifically, moving it off Saadiyat island – was described to me by one anonymous source in Abu Dhabi. As he explained, shortly after the UAE had become independent in 1971, the government began to think differently about the future of Saadiyat, the island where the greenhouses were located. In particular, new plans were made to develop the island as a special, select enclave for the capital's elites. When Sheikh Zayed had originally commissioned the project, he saw it as a way to provide jobs for the poor residents of this island. The greenhouses rapidly lost their allure as a shining icon of modernity as the Emirate was able to reap large and increasing oil revenues. Furthermore, the image of benevolence that Zayed sought to cultivate through the project was suddenly far less relevant on this small scale in the era of independence. In short, the calculus had changed and now these individuals were to be relocated. Together, these factors help explain why the UA project is not well known in the UAE today: quietly forgetting it – unspectacularizing the spectacle – returned Saadiyat to a *tabula rasa*, while not tarnishing Zayed's paternalist image.[12]

Reimagining Saadiyat as empty, undeveloped land was indeed successful, as the island is known today for its new, ultra-elite icons of modernity. The site where the greenhouses once stood is now occupied by Abu Dhabi's new Louvre Museum[13], designed by Jean Nouvel and opened in 2017. Just around the corner a Frank Gehry-designed Guggenheim is set to open in 2022. And further along the road is the extravagant St. Regis Saadiyat Island Resort[14], which hosts some of Abu Dhabi's most high-profile visitors, conferences, golf tournaments and more. In additional to these and other iconic sites, Saadiyat is also the home to the private New York University-Abu Dhabi[15] – the stunning, $2 billion branch campus fittingly touted as exemplary of the most modern 'green building' practices in the UAE to date (see Koch 2018a). The University of Arizona's greenhouse project in the desert may have been brushed aside, but the fact that it has been overwritten by newly spectacular visions of modernity is a testament to the tremendously *political* power of forgetting of spectacle.

5. AgTech and its predecessors: spectacle and the politics of forgetting

At first glance, the AgTech entrepreneurs, start-up incubators, and the rich flows of funding coming from the Emirati state today may appear quite detached from a (then) hi-tech greenhouse/desalination facility opened in Abu Dhabi nearly fifty years ago. As I have suggested in this article, however, they cannot be viewed separately because the contemporary AgTech initiatives in the UAE have a deep history in the region. The geopolitical context is radically different from then and now, but the logic of spectacle and the high-modernist aspirations of 'making the desert bloom' bear uncanny resemblance. This is because the spatial and temporal workings of spectacle as a political technology are common to how these initiatives are promoted and brought to life, and because those trafficking in these images are also trafficking in common narratives and spatial imaginaries about 'modernity' and the desert as a particular kind of place – a 'wasteland' that is not simply deficient, but in need of intervention to be tamed and made productive. These scripts have been an essential glue binding the networks of politicians, scientists, and the media. But they do not exist passively. They are actively curated and disseminated by interested actors, who seek to promote themselves and their political

[12] Anonymous interview, February 2019.

[13] https://www.louvreabudhabi.ae

[14] https://www.marriott.com/hotels/travel/auhxr-the-st-regis-saadiyat-island-resort-abu-dhabi

[15] https://nyuad.nyu.edu/en

agendas as variably modern and cutting edge. The 'desert' provides an especially useful foil for the drama and impressiveness of their alleged achievements in the most harrowing, inclement, exotic, uncivilized, or otherwise oppositional settings. Spectacle requires producers *and* audiences. Further, as I noted at the outset, it requires that those seeking to evoke amazement at some feat in the desert tell their story again and again.

So where does this leave us? Does Abu Dhabi's forgotten University of Arizona project have any broader lessons for the more contemporary push for AgTech around the world? And how might political ecology account for the kind of 'spectacular forgetting' that it will likely engender in the future? One of the major challenges with promoting agriculture in the Arabian Peninsula, as elsewhere, has been its cultural associations with 'backwardness' and tradition, which run directly counter to prevailing technomodernist nationalist identity narratives (Arthur and Al Qaydi 2010; Beaugrand 2014; Jones 2010; Menoret 2011; Joseph 2015). On one hand, the technofetishistic allure of AgTech narratives today goes a long way to reducing the negative stigma of agricultural work. On the other, the risk of these initiatives, such as those of the Emirati companies noted at the outset, Pure Harvest, Badia, and Madar Farms, is that while they may succeed in enlisting young and optimistic entrepreneurs to get involved in agriculture, they do so on the basis of a 'silver bullet' ideology that was also seen with the 'Green Revolution' discourses. Insofar as AgTech discourses today perpetuate this plug-and-play, one-size-fits-all approach to a sector that is highly complicated, politically sensitive, and resource-intensive, they threaten to reproduce the very same problems that were seen during the last great wave of fetishizing agricultural technologies. In all cases, they have often been underpinned by a gross neglect of the *contextual* ways that water, energy, food, and labor are all interconnected. As the complicated and convoluted history of the University of Arizona's ERL project in Abu Dhabi illustrates, these contextual factors necessarily intersect with specific (geo)political forces, which ultimately define their success or failure.

Plug-and-play ideologies – best exemplified by the stackable shipping containers converted to greenhouses pictured in Figure 1 – weave a fiction of the possibility of becoming detached from geography. Political ecologists are intimately familiar with the pernicious effects of this fiction, but the often implicit 'solution' of this critique – attending to local geographies – is not exactly a 'solution.' This is because, even where geography is considered and resource limitations are part of the AgTech story, some of the same problems of spectacle arise. For example, today there is no shortage of 'visionary' efforts to transform deserts of the world into productive places. A number of research networks and organizations continue to promise hi-tech solutions to the challenges of dryland agriculture, such as the International Center for Biosaline Agriculture (ICBA) headquartered in Dubai, the International Center for Agricultural Research in the Dry Areas (ICARDA) headquartered in Beirut, the Global Dryland Alliance (GDA) headquartered in Doha, and the International Arid Lands Consortium (IALC) led by the University of Arizona in Tucson.

Like the wide-ranging AgTech projects of the day, these dryland agriculture initiatives also harness the idea of heralding a new, promising future. In this case, though, the idea of the desert is also harnessed as part of this imagined future to narrate a world of dwindling water resources – but one that technological innovations might overcome. Even while normalizing the spectacle of making the desert bloom, these dryland agriculture programs emphasize the temporality of spectacle and high modernism: the future. Sometimes grim, sometimes utopian, this is a vision of the future, which forgets the past. It forgets that deserts have *always* been under cultivation – but within limits and without the pernicious drive of market forces to put profit above respect for the earth.[16] Spectacular forgetting may be pervasive, but insofar as it works to obscure structural inequalities and environmental violence, reminders of failure are bound to crop up eventually. That may not be the titillating story about the future that high-flying politicians, scientists and the media want to sell, but it is at least a more accurate one.

[16] As just one case among many, consider the ancient Hohokam people's canalization of Arizona (VanderMeer 2010).

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