This Garden of the Sun: A Report on Almería's Miracle Economy

by Melissa Cate Christ

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When the human desire to have the food we want whenever we want it is coupled with industrial production processes that benefit the world's most affluent, a global chain of political, economic, social, and environmental causalities is set in motion. At this moment of extravagant consumption, we often forget that food was once intimately and precariously tied to seasonal availability, local climate, and cultural heritage; it is only recently that food itself began to appear as just another commodity, delivered by way of refrigerated containers in a logistically optimized global transportation network. In response to the technopolitical advances in optimized yields and maximized capacities, many regions have moved to increase the exploitation of natural and human resources to further capitalize on their localized advantages for industrial food production.[1] Because of global market transformations, such local production is required to satisfy out-of-season desire. Exemplary of an area marked by this global shift towards omni-seasonal availability is the province of Almería in Andalucía, southern Spain.

fig. 4

When viewed from a satellite, the expanse of greenhouses in Almería resembles a monochromatic patchwork quilt, stitched together by roads and punctuated by the rectangular *balsas* (swimming pool-like reservoirs) that hold pumped groundwater in reserve for on-demand irrigation. From the ground, however, this apparent continuity disappears, revealing instead a landscape of stark contrasts, exemplified by the route I followed from the 2249m-high, goat-strewn Sierra de Gádor mountains, through fields of reflective white plastic on the Campo de Dalías, a burgeoning company town called El Ejido, boom-era condos and high-end golf courses, and ending at the glistening blue of the Mediterranean. While this area can easily be mistaken as one giant vegetable factory due to the greenhouses' dramatic aesthetic figuration on what was once a barren desert background, the totalizing view from the sky underestimates the heterogeneous, continuous, and intensive human agency required on the ground in order to produce tender crops like tomatoes, even with the unique geographical and climatic conditions specific to Almería.

El Milagro de Almería

Before visiting, I was confronted during my research with a wealth of superlative claims: Almería is, by turns, home to the largest concentration of greenhouses in the world, the driest area of Europe, the primary source of Europe's winter salads, home to the largest population of foreign-born residents in Spain, and the site of the largest desalination plant in Europe. This collection of descriptive extremes—scalar, geographical, industrial, economic, technological—nevertheless allow Almería to be compared with other industrial landscapes of extraction and production developed to exploit a region's natural resources. What is especially unique to Almería, however, is that the foundation of the explosive growth of the horticulture industry is the climate itself. With anywhere between 3,200 and 3,500 hours of sunlight per year,[2] strong Mediterranean winds, and an average of 18 degrees Celsius in the winter, its climate is a formidable lure for mass agricultural production. As these optimal climatic coincidences were matched with relatively simply greenhouse construction techniques, an accessible groundwater supply to offset the less than 300mm average annual rainfall, a precarious immigrant labour force, and the continuing appropriation and deployment of advanced technological innovations, the so-called *el milagro de Almería* (the miracle of Almería) has emerged in less than 40 years.

With nearly 27,000 hectares of greenhouses, located primarily in the low-altitude plains of the Campo de Dalías, and in the higher Campo de Níjar, this so-called "plastic sea" produces almost 3 million tonnes of vegetables per year (2009), half of which are exported.[3] These exports comprise 50 per cent of the peppers, 25 per cent of the tomatoes and cucumbers, and significant quantities of eggplants, zucchini, green beans, and melons for the major supermarket chains in Europe.[4] Such a scale of production is praised for contributing almost 2 billion euros per year to the struggling Spanish economy.[5] In total, the 13,500 family-owned greenhouse operations directly employ 40,000 people, while their agribusiness cluster of over 500 supporting industries, such as plastic manufacturing and recycling, vegetable packaging and distribution, and seed production and seedling breeding employs 19,000.[6] In addition, the area provides itinerant employment for an estimated 100,000 migrant workers, primarily from northern and sub-Saharan Africa.[7] The rapid expansion of this vegetable economy is reflected in the 75 per cent increase in the province's population since 1981, when there were only 7,000 hectares of greenhouses and the province was one of the poorest in Spain;[8] comparatively, in 2012, Almería's GDP per capita ranked third in the country.[9]

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Water, Waste, and Labour

The success of this solar-enabled, desire-fueled horticultural production is not without attendant costs— externalities riddled with contradictions and violence. The most serious impacts to the environment include the depletion of the region's aquifers and their contamination through polluted wastewater discharge and salt-water intrusion. Although the adoption of drip irrigation, *enarenado* artificial soil layering, and soilless substrates such as perlite or coco-peat, were intended to reduce water use through decreased evaporation and direct application of water and fertilizer to the plant roots, these effects have not been fully realized.[10] Instead, the reliance on vernacular practices of overwatering and the high cost of using deep-well (confined aquifer) water, recycled wastewater, or desalinated water from Carboneras, contributes to continuing practices of over-exploitation. Excessive extraction has led to a 15m drop in groundwater levels in 15 years, and helped produce an average rate of 5mm of subsidence per year in some areas of the province.[11] In the Campo de Dalías, where the majority of the oldest and least technologically advanced greenhouses are concentrated, horticultural practices have led to the Norias lagoon, which emerged as early as 1998 in a lutite quarry. This remarkable site is assumed to be the result of a combination of subsidence, increased wastewater discharge, the shallowness of the unconfined aquifer below and the decrease in extraction due to the decline in the water quality because of saltwater contamination.[12] The lagoon is currently being pumped for treatment and reuse, as well to reclaim flooded land formerly home to makeshift housing for workers, ramshackle greenhouses, and industries such as waste management; it is also used as an informal dumpsite for construction, and plastic and vegetable waste. Ironically, it is the only "naturally" vegetated area amidst hectares of closely packed greenhouses, with successional vegetation filling the abandoned *parral* structures and water edges. Because it remains somewhat secluded, this postnatural site has become a popular fishing spot for migrant workers and home to a diverse population of local and migrating birds.

Officially, the increasing amounts of pesticides and chemical fertilizers, contaminated vegetable waste—over 700,000 tonnes per year—and garbage plastic are collected for "recycling," which tends to include various combinations of composting, burning, and shredding. In actuality, substantial amounts of these waste products often end up illegally dumped in the Norias Lagoon, vacant lots, or *ramblas* (stream beds) to be washed into the sea[13] by the infrequent but often devastating autumn *gota fría* (torrential downpours); much of what is not washed into the sea is left instead to slowly leach toxins into the groundwater.[14]

As the industry has grown, plot sizes and the number of crop turnovers per year have increased two- to three-fold, forcing the traditionally family-run farms to rely more heavily on paid labour, which is both their highest cost (46 per cent as of 2005[15]) and the area where they can most increase profits by paying lower wages to legal and illegal migrant workers. Almería has the highest population of immigrants in Spain, over half of whom work in intensive, horticulture-related industries.[16] Some of the social and political economic consequences of this demographic shift reported in recent years include the sub-standard working conditions and subsistence-level wages of many underpaid migrant workers.[17] The influx of migrant settlements has also led to labour disputes and race riots, particularly in 2000 and 2008. Worker illnesses linked to long hours in excessive heat breathing chemically tainted air in insufficiently ventilated greenhouses have also dramatically increased.

In response to these attendant realities accompanying the miracle economy, a number of corporate, academic, governmental, and community programs have been initiated, spinning off other new industries, products, and research. The dream of transforming these social and environmental contingencies into neoliberal opportunities for profit has many variations here, including the development of the saline water-tolerant "RAF tomato," a French variety developed in 1969 and sold as a luxury product to high-end restaurants for 10–15 euros per kilo. Another variation of this dream is vegetable waste being used to generate energy by being processed into fuel briquettes, assuming that the entangled plastic from the twining vines can be efficiently removed to prevent the release toxic fumes when it is subsequently burned.[18]

fig. 9

Aside from the excessive production of solid waste, which stubbornly refuses to be dreamt away, the most pressing issue in Almería is the dwindling supply of fresh, clean water. In addition to the 700m-deep confined aquifer well drilled in 1985,[19] and the Benínar Reservoir, the largest source of fresh water is the desalination plant in Carboneras, completed in 2005 on the eastern coast of the province, in the middle of the Cabo de Gata-Níjar Natural Park. Although this desalination plant is currently working at only 15 per cent capacity, it meets the needs of all the greenhouses in the Campo de Níjar (some 7,000 hectares) and in so doing suggests that the seemingly infinite supply of the Mediterranean itself is yet to be fully exploited. The Carboneras plant has positioned the desalinated water supply as the miraculously "sustainable" future of the region, despite a cost of 1.5–4 times above that of pumped water[20] and the enormous amount of energy needed for industrial processing.[21]

Undoubtedly, technical innovations in water recycling processes have been implemented as partial solutions to the dwindling, and therefore increasingly expensive, water supply. In the most technically advanced, multi-tunnel, rigid plastic greenhouses, computer-controlled passive ventilation and water recycling systems are employed to monitor and control nutrient and salinity levels, adding fresh water and fertilizer depending upon the needs of the plants. To promote the adoption of new techniques and the potential of the industry to become more productive and sustainable, the Andalusian Medal-winning vegetable producer Clisol Agro stocks their show greenhouse with over twenty varieties of colorful tomatoes and provides tours and educational talks to tourists. According to my guide, Lola Gómez Ferrón, who is also the founder of the company, in the

Clisol show greenhouse, recycled water comprises 30 per cent of the total irrigation requirement, with the remaining 70 per cent made up from groundwater (in this case extracted from the confined aquifer well).[22] The company also employs integrated pest management, as well as "natural" chemicals such as sulphur dust, to manage the spread of tomato diseases.

The proliferation of unintended externalities is essential to consider for understanding Almería's peculiar overdevelopment. As an especially telling example, the vernacular tradition of whitewashing the plastic roofs of the greenhouses in the summer to reduce solar gain inside has been linked to a three-degree Celsius decrease in the areas' median temperature. In this regard, the dense expanse of greenhouses, capable of harnessing the energy of the sun to produce vast quantities of vegetables, could also be credited for their role in countering the effects of global climate change.[23] Yet, for each example of a positive, if unintended, externalized outcome, there is a nagging caveat to be reported as well. For example, the use of expensive, desalinated water and recycled water has only reduced, rather than replaced, the amount of groundwater bought from the government or pumped from small and sometimes illegal wells. The combined effect of such practices is that the full extent of water scarcity is not acknowledged, let alone fully known, and a long-term management plan for the province's water resources has yet to be completed.[24] Although there have been several efforts to engage stakeholders and the local community through educational publications and GIS-enabled online mapping and documentation initiatives, budget cuts associated with Spanish austerity measures have slashed the funding for these pedagogical projects.[25]

When viewed on a global scale, covering the ground with plastic and drawing water from the sea could be seen as "progressive" moves because these practices reduce the heat island effect and the consumption of irreplaceable water resources from confined aquifers. Read more carefully, however, "progress" is simply the act of exchanging one finite resource for another; even if the Mediterranean is rarely conceived as a finite natural resource, the energy required to desalinate its water must inevitably be understood as a operating within a limited economy. Harnessed by global capitalism, omni-seasonal desires have enabled the extreme manipulation of Almería's landscape; reading such a landscape requires an equally dramatic shift in logic—a movement from a restricted (no matter how it is traded-off) to a general economy. The transformation of the province—from a poor, under-populated desert to one of the most economically productive regions in Spain—through the expedited exploitation of its natural resources demonstrates the potential to capitalize on localized climate conditions and harness all adjacent industries to intensely expand the horticulture industry. While each component of the process has been isolated, mechanized, and streamlined, there is no escaping the essential fact: such an investment must be spent within a general economy, either gloriously or catastrophically. My experience in Almería—witnessing the struggles of immigrant labourers who work for such low wages to deliver perfect tomatoes to the tables of Europe's most affluent consumers—suggests little in the way of glorious expenditure; instead, I witnessed vast quantities of light, labour, and land squandered for the production of an image, and a taste, of the omni-seasonal salad.

Gracias Difunta Correa

Situated at the edge of a carbonate cliff dividing the windsurfer destination of Almerimar from the greenhouse-engulfed town of El Ejido, a tiny shrine sits behind a pile of two-litre plastic bottles filled with water. It is the lone human construction in a landscape of tough native plants capable of surviving, without human intervention, the harshest of conditions. A sign, now knocked to the ground, provides the shrine's dedication: "Gracias Difunta Correa." Patron saint of farmers, travellers, and the desert, the historical figure of Difunta Correa is reputed to have followed her abducted husband into the deserts of Argentina with her infant son. Although she was found dead by soldiers some time afterwards, her infant was still alive, sucking her still full breast even after her torturous death in the desert sun. There can be no better patron of the desire that fuels Almería's development, and series of superlatives that accompany its growth than, Difunta Correa, especially considering the offerings she receives: water to calm her eternal thirst.

The shocking satellite image of greenhouses in Southern Spain may stand in well for the processes playing out in and among them. However, when seen as a source and solution to problems such as seasonal inconsistency, economic instability, global climate change, and environmental degradation, industrial-scale food production is far more than an image; this intensive human, mineral, and vegetable assemblage reproduces social and environmental relations, normalizing the processes and practices that characterize industrial horticulture and the standing-reserve of commodities it affords. Devotion to the Argentinean populist saint Difunta Correa—whose shine itself is made up of the twin necessities of the *milagro de Almería*, namely, water and plastic—speaks to the hopes of a region both blessed and tortured with over 300 days of sunshine every year. Her desire for devotees to quench her eternal thirst is indelibly related to her suffering under the solar resource powering Almería's miracle economy; how long she can sustain her own miraculous sating of the parched desire for earthly, maternal plentitude is strictly a matter of faith.×

fig. 10

fig. 11

Figures

1 "Taster" tomatoes at Clisol's show greenhouse.
2 1.5ha plots, each with a balsa to store pumped groundwater. Image: Jesus Contraras
3 A parral-type greenhouse growing melon in spring.
4 Campo de Dalias and El Eijido
5 Drip irrigation system at Clisol
6,7 Anthropogenic Norias lagoon. Image: Jesus Contraras
8 Worker housing. Image: Jesus Contraras
9 Carboneras desalination plant. Image: Jesus Contraras
10, 11 Shrine to Difunta Correa

Endnotes

Special thanks to Balbino Fernández Revuelta, Issac Frances Herrera, Lola Gómez Ferron and Jesus Contreras for their hospitality and generous conversations during my stay in Almería.

1 Historian of science Paul Edwards describes "technopolitics" in the following terms: "Engaging in technopolitics means designing or using technology strategically to achieve politic ends. Symmetrically, it also means using political power strategically to achieve technical or scientific aims." See Paul Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge and London: MIT Press, 2010), 215.
2 José A. Aznar-Sánchez and Emilio Galdeano-Gómez, "Territory, Cluster and Competitiveness of the Intensive Horticulture in Almería (Spain)," *The Open Geography Journal* 4 (2011): 103–114.
3 Ibid, 103.
4 Robert Tyrell, *El Milagro de Almería, España: A Political Ecology of Landscape Change and Greenhouse Agriculture* (2008, unpublished thesis), 39.
5 Junta de Andalucía, *Consejería de agricultura y pesca memoria anual: 2009* (Sevilla: Servicio de Publicaciones y Divulgación, 2012), 12.
6 Aznar-Sánchez and Galdeano-Gómez, "Territory, Cluster and Competitiveness," 110.
7 Although there is no official census of migrant workers, this number is an estimate based on calculating that 40,000 greenhouses need 2–3 outside labourers each. The portion of this number made up by legal immigrants is estimated to be betwen 10,000 and 40,000 of the total. See George Prior, "The Greenhouse Effect in Andalucia," *SUR in English*, http://www.surinenglish.com/20110609/news/andalucia/greenhouse-effect-almeria-20110609 1703.html.
8 Almería's population has increased from 405,000 in 1981 to 704,000 in 2012, 155,000 of which are primarily immigrants from northern and sub-Saharan Africa. The exponential growth is relatively recent: close to 200,000 people were added in just the last 10 years. By contrast. Spain's population as a whole only increased 25 per cent, from 37,741,000 in 1981 to 47,190,000 in 2011. See Instituto Nacional de Estadistica (Spanish Office of Statistics), http://www.ine.es/en/inebmenu/mnu_cifraspob_en.htm, and Gemma Quinn, "Almeria Exceeds Population of 700,000 for First Time," *Leader.info*, 10 April 2011, http://www.the*leader.info*/362/article/28168/almeria-exceeds-population-of-700000-for-first-time.
9 Cynthia Giagnocavo, "The Almería Agricultural Cooperative Model: Creating Successful Economic and Social Communities," (paper presented at the 50th Session of the Commission for Social Development, UNHQ, New York, NY, 1–10 February 2012), ii.
10 In the 1960s the industry began its transformation through the adaptation of basic technological improvements. Existing grape trellises (*parral*) were covered in newly available polyethylene sheeting in order to insulate the *enarenado* soil, a layering technique first employed in the 1920s. Still in use by over 80 per cent of the region's 1.5-hectare parcels, the native soil is topped by a 15cm layer of clay, a 5cm layer of compost and then a 10cm layer of sand. This technique reduces evaporation and salt uptake, as well as water loss through the rocky, nutrient-poor soils. The other 20 per cent of the greenhouses use substrates such as bags of perlite or planters of shredded coconut fiber (commonly sourced from India) in order to reduce soil-borne diseases.
11 Antonio Pulido-Bosch et al., "Identification of Potential Subsidence Related to Pumping in the Almería Basin (SE Spain)," *Hydrological Processes* 26, no. 5 (2012): 739.
12 A. Vallejos et al., "The Intensive Exploitation of Aquifers and Its Implications for Sustainable Water Management in a Semi-Arid Zone," *Groundwater International IAHR Symposium: Flow And Transport In Heterogeneous Subsurface Formations: Theory Modeling And Applications* (Istanbul: Bogaziçi Universitesi, 2008), 661, http://nevada.ual.es/proyectoexcelencia/docs/23.pdf.
13 In March 2013, one of 1,000 remaining sperm whales in the Mediterranean was found washed up on a beach on the southern coast of Spain with 17kg of plastic waste clogging its stomach, the majority polyester sheeting, speculated by scientists to have originated from the "plastic sea" in Almería. Giles Tremlett, "Spanish Sperm Whale Death Linked to UK Supermarket Supplier's Plastic," *The Guardian*, 8 March 2013, http://www.guardian.co.uk/world/2013/mar/08/spain-sperm-whale-death-swallowed-plastic.
14 Luis Molina-Sánchez et al., "Agricultural Waste Management and Groundwater Protection," (paper presented at the 38th IAH Congress, Groundwater Quality Sustainability Conference, Krakow, Poland, 12–17 September 2010).
15 Nicolas Castilla and Hernadez Jaquan, "The Plastic Greenhouse Industry of Spain," *Chronica Horticulture* 45, no. 3 (2005): 18.
16 Estimate calculated from Quinn, "Almería Exceeds Population," 2011, and Felicity Lawrence, "Spain's Salad Growers Are Modern-Day Slaves, Say Charities," *The Guardian*, 7 February 2011, http://www.guardian.co.uk/business/2011/feb/07/spain-salad-growers-slaves-charities.
17 See Ibid., and the Belgian documentary *El Ejido, la loi du profit*, directed by Jawad Rhalib (France: Arte, 2006), for recent accounts of the working conditions of migrants in Almería.
18 A. J. Callejón-Ferre and J. A. López-Martínez, "Briquettes of Plant Remains from the Greenhouses of Almería (Spain)," *Spanish Journal of Agricultural Research* 7, no. 3 (2009): 525–534.
19 Tyrell, *El Milagro de Almería*, 26.
20 Elena López-Gunn, Marta Rica and Nora van Cauwenbergh, "Taming the Groundwater Chaos," in *Water, Agriculture and the Environment in Spain: Can We Square the Circle?* ed. Lucia De Stefano and Manuel Ramón Llamas (Leiden: CRC Press/Balkema, 2012), 237.
21 Although increasingly supplied by renewable resources such as wind or solar power (e.g. as promoted by ACCONIA, the supplier to Acuamed, who runs the desalination plant at Carboneras [Acconia, "ACCIONA Will Supply Electricity to Acuamed for the Third Year Running," ACCONIA Press Release, 19 June 2013, http://www.acciona.com/news/acciona-will-supply-electricity-to-acuamed-for-the-third-year-running]), energy requirements for seawater desalination range from 12,000–18,000 kWh per million gallons. See Heather Cooley and Matthew Heberger, *Key Issues for Seawater Desalination in California Energy and Greenhouse Gas Emissions* (Oakland: Pacific Institute, 2013), 8, http://www.pacinst.org/reports/desalination_2013/energy/energy_full_report.pdf.
22 Lola Gómez Ferrón (founder of Agro Clisol) in discussion with the author, March 2013.
23 Pablo Campra, Monica Garcia, Yolanda Canton and Alicia Palacios-Orueta, "Surface Temperature Cooling Trends and Negative Radiative Forcing Due to Land Use Change toward Greenhouse Farming in Southeastern Spain," *Journal of Geophysical Research: Atmospheres* 113 (2008).
24 See N. Font and J. Subirats, "Water Management in Spain: The Role of Policy Entrepreneurs in Shaping Change," *Ecology and Society* 15, no. 2 (2010): 25, http://www.ecologyandsociety.org/vol15/iss2/art25 for an account of the history of water policy development in Spain, and López-Gunn et al., "Taming the Groundwater Chaos," for a discussion specifically about the status and management of the aquifers in Almería.
25 The Universidad de Almería's Centro Andaluz para la Evaluación y Seguimiento del Cambio Global (Andalusian Centre for Assessment and Monitoring of Global Change), directed by Hermelindo Castro Nogueira, is still in existence, but significant projects including community engagement and outreach activities (such as CAMP, see http://camplevantedealmeria.com/en/content/camp-levante-de-almeria) have been put on hold over the last three years due to budget cuts. See http://www.caescg.org for the Centre's objectives and ongoing projects.

Bio

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