

Case
study

Thermal Futures

Communal Blooms Amidst Climate Jeopardy

As heat continues to build unceasingly, so too do the many notions of heat accumulate in our collective consciousness. Beyond a sense of thermal variance are shared meanings, representations, symbols, and values that underpin these ever-expanding imaginaries of heat. Imaginaries that shape the political, social, cultural, and historical dimensions that constitute the software to the hardware problem that is our climate crisis.

Thermoculture, thermopower, thermopolitics, and other fields of thermal studies have emerged amidst the increasing need to reorder our lives and effect policies that mitigate warming global temperatures. These sudden urgencies mask over the fact that much of culture, economics, and politics were themselves shaped by heat. As new thermal policies and lexicon are introduced into our lives, the climate crisis, in turn, presents us with opportunities to comprehend the crisis beyond its crystallization into a single world—*carbon*.

This case study looks to explore the many imaginaries of heat and their many possibilities. In fully grasping heat's complexities, may we then manifest new forms of thermo-dynamics in the forms of thermo-intimacies, thermo-solidarities, thermo-communities, and perhaps thermo-revolutions.

Pulso: Kent Chan

Facilitating entity: Parque de las Ciencias
with the support of Junta de Andalucía, Diputación de Granada, Ayuntamiento de Granada, Universidad de Granada y Consejo Superior de Investigaciones Científicas (CSIC)

In collaboration with: BC3 Basque Centre for Climate Change; Dirección General de Sostenibilidad y Control Ambiental - Ayuntamiento de Madrid; Hábitat, Energía y Arquitectura en Transición HEAT-UPM, and Oficina Española de Cambio Climático OECC - MITECO

Case study's collaborating entities:



HEAT



PARQUE de las CIENCIAS
ANDALUCÍA - GRANADA

Case study's facilitating entity:

Initiative promoted by:



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02. Case study conceptualization

In the first half of this century, the median number of days with heat waves in Spanish municipalities is expected to triple, coupled with a 65% increase in household cooling.¹ The consequence of this warming, though, is felt unevenly over different sections and communities of the populace.

From so-called climate shelters to summer energy poverty, there are ever-increasing measures, metrics, and policies to address, adapt, and mitigate the consequences of the climate crisis. Rather than taking the perspective of ecological breakdown as the (manmade) evolution of climates, it is perhaps better to conceive of it as a thermal revolution playing out over time. A revolution in which the realization of and the necessary lessons and curriculums in dealing with the climate crisis are being conceived belatedly in real time.

Thermal Futures examines the different extreme heat mitigation strategies being developed within the Spanish context for its urban populaces. Looking at the material, spatial, and social aspects of these strategies in preparing the populaces to deal with what are increasingly frequent extreme heat events. Turning jeopardy into opportunity, the case study looks at how these people-centered strategies could also be opportunities to build communities for the unfolding climate futures.

Not only in terms of thermal preparedness, but also in drawing diverse references in creating an expansive form of thermal literacy that leads to wider communal connections. Where “heat” becomes the lens through which historical, cultural, and socio-political relations can be addressed to build the communities and societies that our climatic futures demand.

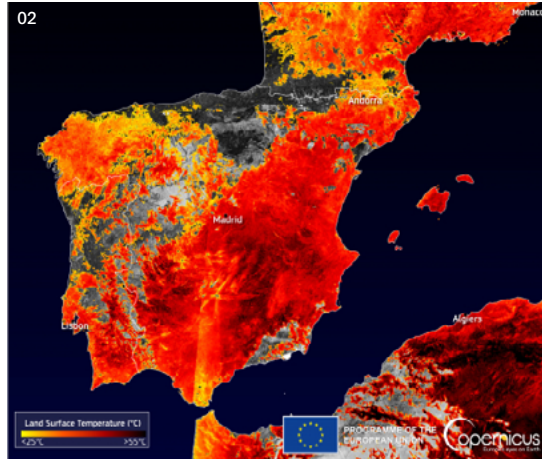
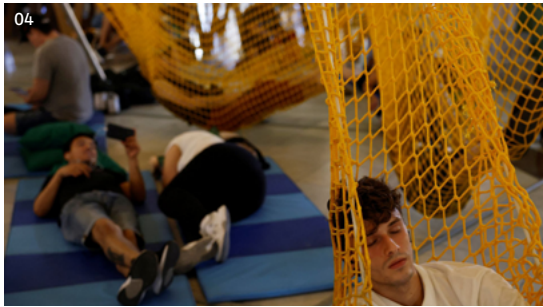
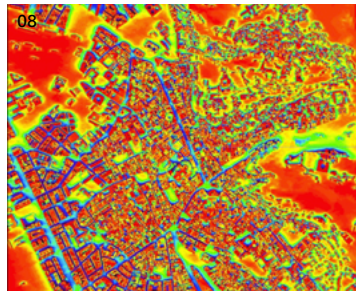
The case study will explore what forms of initiatives and spaces could take shape to not only provide refuge from periods of extreme heat but also build communal bonds that collectivize mitigation. Spanning the territory of Spain, central to the case study are the perspectives of climate and thermal justice—the uneven spread of heat distribution versus relief. The case study will draw on both historical and contemporary references of how heat has been culturally and politically conceived and dealt with across different geographies, climates, and communities. What new climate-resilient crops are being grown that already have a long history in Spain? What heat-mitigation strategies can be learned from other forms of heat from distant lands?

Thermal Futures explores how one might conceive spatially of a climate commune. Whether it might create new ones beyond the existing communities that it'll serve. Bringing into question the possibilities beyond its essential role as a shelter from heat. The case study will draw from different knowledge, skillsets, and expertise in the process of prototyping such a space. Simultaneously building an expansive curriculum around the many contexts and imaginaries of heat to perhaps kickstart a thermo-revolution. Allowing us to take the lead rather than merely playing catch-up in our living with the climate crisis.

Case study's applied dimension:

The Parque de las Ciencias in Granada grounds the applied dimension of the case study in one of the Spanish cities most vulnerable to urban heat. In Granada, frequent heatwaves coexist with a fabric of housing and urban green space unable to offer sufficient relief, driving a growing demand for cooling. This thermal hazard hits hardest in contexts of socioeconomic vulnerability. In line with emerging developments in the spread of climate oases, the Parque proposes opening part of its facilities as a free-access space, porous to the city. The aim is to consider how this infrastructure might be put to work sheltering people from the heat, while also becoming a site of civic empowerment. There, ways of adapting and repairing our environments through inclusion and equity would be explored in a co-design process with a broad network of local actors. What narratives and design strategies can be activated to explore the transformative potential of these infrastructures? In turn, research into and prototyping of what a climate oasis could become for a cultural institution will inform the architectural and programmatic design of the Museo Nacional Thyssen-Bornemisza's expansion.

1. 300.000 Km/s & Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS). (2026). Atlas de vulnerabilidad al calor [Heat Vulnerability Atlas; interactive atlas]. Impetus4Change project. - <https://lab.300000.eu/calor/>



1. Kent Chan, still, *Future Tropics*, 2023/2024.

2. European Union, Copernicus Sentinel-3 imagery, 2022-06-15.

3. Homeless Danilo da Silva uses a fountain to cool off and wash himself, during a heatwave in the Anhangabau Valley, in the centre of Sao Paulo, Brazil September 22, 2023. Credit: Reuters.

4. People hang out at a climate shelter at the Círculo de Bellas Artes cultural center during a heatwave in Madrid last August. Credit: Susana Vera, Reuters.

5. Aerial views of Forever Grateful Ranch where owner Jim Chew grows pistachios, in Chowchilla, CA, about 150 miles east-southeast of San Francisco, on Nov 19, 2018. Open Source.

6. Kent Chan, still, *Solar Orders*, 2024.

7. Air conditioning units on a block of flats in Madrid. Credit: Isabel Infantes, Reuters

08. Termografía del núcleo urbano de Granada, 05-07-2018. Huellasolar, «Aplicación

Web. Mapas de Soleamiento y Radiación de Ciudades», 2018.

09. Calle Sierpes, Sevilla, late 19th C. Open Source.

10. Aerial view, Parque de las Ciencias, Granada. Credit: Christian Baeza.

03. Key research approaches

Imaginaries of heat

What is evoked when thinking of heat? Heat waves, wildfires, droughts, deserts, the tropics, the Global South or is it summer vacations, winter escapes, and the many other evocations? Thinking of heat requires thinking not of events and/or places in silo, but a framework of symbols, values, aesthetics, and communities. The same tropics or desert might evoke different imaginaries depending on who is imagining them. Which communities then and what kind of imaginaries should be evoked when conceiving of such a climate commune?

Histories of Spanish climate adaptations

In the Ordinances of 1573, the Spanish Crown established strict regulations for where and how to build new settlements in the brutal colonization of the Americas. The preference for highlands and elevated plateaus overwhelmingly placed their primary seats of administrative and political power in high-altitude inland regions. Highlands offered a moderate microclimate that felt familiar to Iberian settlers, escaping the tropical heat. What lessons could be drawn from Spain's colonial past and its adaptations to the heat to which it was unaccustomed?

Food crops and their milieus

Whether it's the high plains of the inland north or the Costa Tropical of the coastal south, the varied terrains and microclimate of Granada allow the cultivation of a wide variety of crops: cherimoya, avocado, mango, papaya, lychee, and pistachio, amongst others. While most have long been widely grown in Granada, others are relative newcomers. Yet they are similar in how they had come from distant lands and given time to adapt to the climate and take root in the land. Lands that many of the communities within Granada similarly hail from. What might we learn about communality through these very cultivations?

Commune cooling

What distance and what does it take to walk or arrive at a climate commune? Summer energy poverty means there is an inequality in households' ability to keep their living spaces adequately cool during extreme heat events due to a combination of low-income, high-energy costs, inefficient housing, and lack of access to public cooling infrastructure. What might such a climate commune do to bridge or shorten the distance needed for the most vulnerable to arrive? What forms and methods of cooling can it provide alongside governing entities, and incorporate systemic designs that then find their way to the homes of those most in need of cooling?

Thermo-sustainability

With the climate crisis here to stay for generations at the very least, how do we conceive of a climate commune with longevity in mind? With most short-term project-funded spaces in Europe lasting between one and three years, how does an initiative sustain itself and continue to serve the communities it helped build beyond the typical 12-to-36-month grant lifecycle? What other forms of longevity and sustainability can such a climate commune look to cultivate?

04. Pulso

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Kent Chan

Kent Chan is an artist, curator and filmmaker based in the Netherlands and Singapore. His practice revolves around our encounters with art, fiction and cinema that form a triumvirate of practices porous in form, content and context. He holds particular interest in the tropical imaginary, the past and future relationships between heat and art, and contestations to the legacies of modernity as the epistemology par excellence. His works have taken the form of moving-image, text, performances, and exhibitions. He is a former resident of Gasworks, Art Explora, Pivô Research, Jan van Eyck Academie, MMCA Residency and his works and films have been exhibited in institutions and festivals including Tate Modern, MMCA Seoul, Liverpool Biennial, Videobrasil, International Film Festival Rotterdam, and Seoul Mediacity Biennale.



Portrait: Diana Pfammatter for CCA Berlin

1. Kent Chan, *Solar Orders*, still, 2024

2. Kent Chan, *Weather Casting*, still, 2026

3. Kent Chan, *Idols Idle*, Wu Space of Contemporary Art, 2026

05. Facilitating entity

Parque de las Ciencias

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→ The Parque de las Ciencias is a 70,000 m² interactive science museum located just a few minutes' walk from Granada's historic center. Since its opening in 1995, it has welcomed more than 17 million visitors. It is managed by a public consortium comprising the Regional Government of Andalusia, the City of Granada, the Provincial Council of Granada, the Spanish National Research Council (CSIC), and the University of Granada. Seven permanent exhibition pavilions, 5,000 m² of temporary exhibitions, the Digital Planetarium, the BioDome, the Cultural Gallery, the biblioLAB, the movie theaters, the Auditorium, and the "Windows to Science" are just some of its spaces. These spaces bring together topics such as health, the environment, architecture, literature, physics, chemistry,

mechanics, and astronomy, among others. Notable among its activities are international projects—both exhibition-based and research-based—and its role as the Spanish headquarters of the European Space Agency's (ESA) Education Office (ESERO). In addition, it is an open-air museum with 27,000 m² of green spaces. For the research and prototyping process of the Thermal Futures case study in Organismo 2027, the Parque de las Ciencias will collaborate with a range of local and regional stakeholders: the Regional Government of Andalusia (Junta de Andalucía), the Granada Provincial Council, Granada City Council, the University of Granada, and the Spanish National Research Council (CSIC)

In collaboration with:

BC3 Basque Center for Climate Change

[web →](#)

→ The BC3 is a research center on the causes and consequences of climate change. Led by one of the most recognized scientists in the climate change field, Prof. Maria José Sanz, they produce multidisciplinary knowledge to support decision-making towards sustainable development at the international level. With a multidisciplinary team, connected to the main scientific institutions, networks and socio-economic agents, for a

decade, their contribution to research on climate change and to the science-policy interface puts them in a unique position to offer knowledge, tools, new methodologies and cross-cutting proposals, that they lead towards action in a collaborative framework with stakeholders, to design and help implement policies aimed at sustainable development.

Hábitat, Energía y Arquitectura en Transición HEAT-UPM

[web →](#)

→ HEAT (Habitat, Energy and Architecture in Transition) is a research group at the Universidad Politécnica de Madrid (UPM) focused on the interaction between climate, architecture, urban environments and energy transition. The group develops interdisciplinary research on environmental design, climate adaptation, building performance, urban resilience and the transformation of the built environment towards more sustainable and equitable futures. HEAT combines expertise in

environmental assessment, low-impact construction, circular approaches, urban sustainability and digital tools for analyzing and improving buildings and cities. Through research, innovation and knowledge transfer, the group contributes to addressing the spatial and social challenges posed by climate change across different scales, from buildings and neighborhoods to urban and territorial systems.

Oficina Española de Cambio Climático (OECC) - MITECO

[web →](#)

→ The Spanish Climate Change Office (OECC) is the directorate of the Ministry for the Ecological Transition and the Demographic Challenge (MITECO) responsible for designing, coordinating and implementing national policies to address global warming. Its main functions can be summarised in four areas of work:

- Mitigation: Develops strategies to reduce greenhouse gas emissions in line with international commitments.
- Adaptation: Promotes and coordinates national

policies to prevent and adapt to the impacts of climate change across the country.

- Carbon Market: Manages the carbon footprint registry and oversees the Emissions Trading System in Spain.
- International Representation: Acts as Spain's focal point to the United Nations Framework Convention on Climate Change and represents the ministry in European and international forums.

Dirección General de Sostenibilidad y Control Ambiental del Ayuntamiento de Madrid

→ The Directorate General for Sustainability and Environmental Control, among other responsibilities, promotes and coordinates municipal policies aimed at making Madrid a more sustainable, resilient and climate-neutral city, integrating climate change mitigation and adaptation into municipal planning and management. In terms of mitigation, it promotes and monitors policies and measures to reduce greenhouse gas emissions, improve air quality and encourage more efficient and sustainable energy use. It also promotes energy efficiency, renewable and lower-polluting energy sources, mobility based on alternative energies and fuels, and improved energy and environmental performance in municipal buildings, facilities and services. These efforts are underpinned by the collection and analysis of data on energy consumption, emissions and other environmental indicators, and by fostering innovation and knowledge in

energy and climate change. In the area of adaptation, it works to strengthen Madrid's capacity to anticipate and respond to the impacts of climate change. To this end, it analyses and monitors climate variables and risks, and promotes measures to reduce the city's vulnerability to phenomena such as rising temperatures, heatwaves, irregular rainfall and ecosystem degradation. This work takes a cross-cutting approach: embedding climate and environmental criteria across municipal policy areas, coordinating with other administrations and institutions, collaborating with businesses and urban stakeholders, and encouraging public participation. The Directorate General also drives the generation and management of environmental data, indicators and knowledge as a basis for planning, monitoring and evaluating the city's climate policies. The entity will be represented by Juan Azcárate and Irene García García.

06. Guest experts

A first selection of voices informing the development of the case study includes the following names. Additional guest experts will join the conversation as the process evolves:



Jiat-Hwee Chang

web →

→ Jiat-Hwee Chang is Dean's Chair Associate Professor of Architecture and Research Leader of Science, Technology and Society (STS) cluster at the Asia Research Institute, National University of Singapore. He is an interdisciplinary researcher working at the intersection of architecture, environment, and STS. He is the author of *A Genealogy of Tropical Architecture* (2016, awarded International Planning History Society's Book Prize 2018) and co-author of *Everyday Modernism* (2023, awarded Society of Architectural Historians Great Britain's Colvin Prize 2023). He is currently working on a book manuscript on the socio-cultural histories and techno-politics of air-conditioning and the built environment in the Asian Anthropocene. He is also co-editing a book on the histories, politics, and cultures of cooling in Asia with Chris Courtney.



Juan Azcárate

→ Juan Azcárate is the Deputy Director of Energy and Climate Change, Urban Planning, Environment and Mobility Area, Madrid City Council. B.S. in chemical sciences (Complutense University of Madrid). Azcárate has developed his professional career within the Environment and Mobility Area of the city of Madrid, holding different positions related to the management and urban environmental control. Currently, he works as Deputy Director of Energy and Climate Change. Among the highlights of his work is the development of the Roadmap towards Climate Neutrality of Madrid, which includes measures focused on urban mobility (alternative fuels and electromobility), energy efficiency in buildings and public space and nature-based solutions for adaptation to climate effects. He is also coordinator for the commitment and participation of the city in international networks such as C40 and the EU Mission of Climate-Neutral and Smart Cities, in which Madrid has been recently awarded the EU Mission label.

**Hsuan L. Hsu**

→ Hsuan L. Hsu is a Professor of English at the University of California, Davis. His recent publications include *The Smell of Risk* (NYU Press, 2020), *Air Conditioning* (Bloomsbury, 2024), and *Olfactory Worldmaking* (Minnesota, 2026). His co-authored (with Sal Nicolazzo) pamphlet, "Candice Lin and Colonialism's Promiscuous Materials" is forthcoming in the Andy Warhol Foundation's Cookie Jar series. With Annette Kern-Staehler, he co-edits the series *Cambridge Elements in Literature, Culture, and the Senses*.

**Parsa Sanjana Sajid**[web →](#)

→ Parsa Sanjana Sajid is a writer, researcher, and cultural practitioner. She works across disciplines and fields spanning digital, visual and literary cultures, social spaces and movements, migration practices, and gender justice. She is the co-editor of a recently published Routledge volume titled *A Bangladesh Reader: Beyond Nation and State* (2026) and recently curated a group show called *Cholo Shoi* using kinship as a theme and collage as a medium to investigate relationships and care networks beyond biological, patrilinear relationships and families (2026). In 2025 she presented an ongoing research project on mud, leisure, and architecture for PARSE Journal's biannual conference titled *Some Like It Hot*.

**Safouan Azouzi**

→ Dr. Safouan Azouzi is a design researcher and scholar working at the intersection of commons theory, political ecology, and decolonial design, with a particular focus on the Tunisian oases and the broader MENA and Mediterranean region. His research bridges ethnography, design studies, and socio-ecological thinking to explore how ancient commoning practices can inform alternative economic models for climate adaptation across the MENA region. He is particularly interested in how communities facing extractivism, water dispossession, and ecological collapse can build resilient, post-capitalist futures through design. A former postdoctoral fellow at Harvard University (Center for Middle Eastern Studies) and the Massachusetts Institute of Technology (Aga Khan Program for Islamic Architecture), he co-directs IFLA's Working Program on Desertification and Sustainable Land Management, promoting regenerative and landscape-based approaches to strengthen dryland ecosystem resilience across arid and semi-arid territories.

07. Expanded study materials

visit [Thermal Futures are.na](https://thermalfuturesarena.com) →

- 1 Arnold, David. "'Illusory Riches': Representations of the Tropical World, 1840–1950." *Singapore Journal of Tropical Geography* 21, no. 1 (2000): 6–18.
- 2 Aznarez, Celina, Sudeshna Kumar, Alba Marquez-Torres, Unai Pascual, and Francesc Baró. "Ecosystem Service Mismatches Evidence Inequalities in Urban Heat Vulnerability." *Science of the Total Environment* 922 (2024): 171215. - [link →](#)
- 3 Chang, Jiat-Hwee. *The Air-Conditioning Complex: Histories and Futures of Hybridization in Asia*. *Environmental Histories of Architecture*, edited by Kim Förster. Montréal: Canadian Centre for Architecture, 2022.
- 4 Cirugeda, Santiago. "Legal Grey Zones and Joyful Construction: Recetas Urbanas' Architecture." Interview by Léopold Lambert. *The Funambulist*, no. 23, "Insurgent Architectures" (May–June 2019). - [link →](#)
- 5 de Sousa, Ana Naomi, and António Brito Guterres. "The Invisible City: Existence and Resistance in the Peripheries of Lisbon." *The Funambulist*, no. 16, "Proletarian Fortresses" (March–April 2018). - [link →](#)
- 6 Gayoso-Heredia, Marta, Miguel Núñez-Peiró, Carmen Sánchez-Guevara, et al. "Mapping Summer Energy Poverty: The Lived Experience of Older Adults in Madrid, Spain." *Energy Research & Social Science* 110 (2024): 103449. - [link →](#)
- 7 "'Green Gold': Spanish Farmers Ditch Olives for Pistachios in Bid to Survive." *The Guardian*, August 27, 2022. - [link →](#)
- 8 Gupta, Devadeep. *Normalisation of a Disaster*. Video, 2020. Vimeo. - [link →](#)
- 9 Hsu, Hsuan L. "Race, Urban Heat, and the Aesthetics of Thermoception." *American Literary History* (2023). - [link →](#)
- 10 Johnson, Ayana Elizabeth, host. "How to Deal with the Heat, with Jainey Bavishi and Jeff Goodell." *What If We Get It Right?* Podcast, November 14, 2025. Spotify. - [link →](#)
- 11 Tschakert, Petra. "Geographies of Thermopolitical Sacrifice." *Progress in Environmental Geography* 5, no. 3 (2026): 203–25. - [link →](#)

Marder, Michael. *Pyropolitics: When the World Is Ablaze*. London: Rowman & Littlefield International, 2015. - [link →](#)

- "Pyropolitics must account for the spatiality of heat—for the ways bodies are drawn together around a source of warmth or repelled by an unbearable blaze. To share a thermal environment is to enter into a relation of mutual exposure, where the boundaries of the self are softened by proximity to the other."

Earle, Rebecca. "'If You Eat Their Food . . .': Diets and Bodies in Early Colonial Spanish America." *American Historical Review* 115, no. 3 (2010): 688–713.

- "Spaniards settled in the high-altitude regions of New Spain and Peru in part because these regions could support the cultivation of wheat and the raising of European livestock, both of which were deemed essential if Spanish bodies were to remain healthy and European."

Chan, Kent. *The Garden Could Have*. 2026. - [link →](#)

- "In keeping a tropical mountain ecosystem cool inside a hot, humid equatorial environment, the Cloud Forest was essentially the reverse greenhouse. Now, it wasn't that such a conservatory had never been built before, just that it had never been built in the tropics. And given how the tropics had historically always been seen as being behind time, the Cloud Forest hadn't just reversed the tropics, uniquely it had propelled the tropics from the past into a science fiction-esque future. And just in case you need reminding, this was way before the whole globe had turned tropical."