Migrant Processing Overflowing Shade. Source: DHS/OIG.

US Customs and Border Protection (CBP) Agents amass in the shadow of the San Ysidro Port of Entry. Source: CBP.

Over-Exposed: Ultraviole(n)t Shade in the Borderland

Course Coordinators:

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Context

The Chihuahuan Desert is a unique and uniquely-challenged binational territory that crosses the US-Mexico border, where climate change is evidenced daily in the combined impacts of climate migration, desertification and urbanization, exacerbating the asymmetric distribution of environmental threats and public health risks to large and largely underserved areas. In the “sister cities” of El Paso (Texas) and Ciudad Juàrez (Chihuahua)—a sprawling binational metroplex of over 2.5 million people—jurisdictional fragmentation and lack of public resources for the assessment and mitigation of extreme climate conditions leave large populations underserved by the regulatory agencies and public health infrastructures charged with their care. With projected increases in climate migration and economic migration to the borderland, even higher numbers of people will be exposed to the environmental and public health threats in this harsh context, demanding urgent attention and the design of new infrastructures of care, at the regional, local, and bodily scale.

One significant environmental threat is the hidden, subperceptual danger of high levels of ultraviolet radiation exposure, surprisingly high even within shaded conditions in public space. The high degree of atmospheric particulate from airborne desert sand, coupled with pollution from anthropogenic sources, scatters damaging UVB rays deep within shaded areas, exposing unwitting occupants of public shade with high levels of radiation that contribute to major health risks including increased prevalence of skin cancer and eye damage. Diffuse radiation levels are highest in areas with high volumes of pedestrian traffic, where thousands of people each day endure long waits under the canopies of pedestrian bridges as they cross the international boundary, or wait in the shade of a bus station in transit hubs to complete their daily commute, unaware of the harmful level of exposure to the sun’s most damaging rays.

Inequitable distribution of public shade amenities in the metroplex contribute to asymmetric health impacts. In low-income areas, extremely reduced access to public shade and street trees subject populations to a form of *slow violence*. Children, without access to outdoor shade, avoid playing outdoors when there is a high UV index—which is much of the year—resulting in significantly lower levels of outdoor activity and exercise, causing poor health outcomes for recent generations. As climate change continues to increase the average daily UV index for the region and the total number of high-index days, this problem, left unattended, will only grow.

The course coordinators have conducted significant research on these issues to date, including focused geospatial investigations detailing the asymmetric conditions of exposure in the region, and the development of custom computational toolsets to visualize and mitigate areas of “irradiated shade” in the borderland. Importantly, Kripa and Mueller’s work illustrates the potential of managing the unique geometry of **sky exposure** to mitigate radiation effects, extending disciplinary capacity beyond the traditional shade studies and radiation analysis available to

architects and urban planners. The amount of sky visible from any point in an urban environment provides a unique corollary to the amount of diffuse radiation exposure, and, using the tools they have developed, the contours of this distinct and invisible geometry can be readily mapped and managed in a 3D design software environment.

Building on this body of work, the course will provide a unique opportunity for students to work toward diverse and immediately actionable outcomes, bringing new strategies and design methodologies for safe shade to regional audiences including public stakeholders and local governance. Students will leverage and expand previous spatial research, visualization methods, and computational toolsets, to identify sites and strategies for immediate action in the El Paso/Ciudad Juarez metroplex.

Course Description

The studio will visualize innovative and effective designs for safe public shade. Student design research projects will provide positive health impacts to borderland communities through architectural and urban design of computationally-informed, radiation-aware public shade structures, designing models and prototypes to enact regional transformations at-scale.

Course Format: Vertical Hybrid Studio, 15 weeks, 6 credit hours
Graduate students at the Texas Tech College of Architecture main campus in Lubbock, Texas (in a remote/hybrid format with scheduled visits to El Paso) and undergraduate students at the Texas Tech College of Architecture El Paso, Texas campus (in-person, with scheduled visits to Lubbock).

Course Content:
The course will advance the architectural discipline's capacity to address unique conditions and hidden dangers within public shade in arid urban environments, where geological material and climate change collude in the production of heightened UVB damage and threaten large populations. Students will conduct collective spatial investigations and design research centered around emerging environmental and spatial justice issues applicable to arid urban environments around the world, with efforts focused within the US-Mexico borderland generally, and the El Paso-Ciudad Juárez binational metroplex specifically. Course readings and discussions will engage students in issues of transboundary health, ecology, and governance strategies and concerns, as well as foundational knowledge in theories of environmental justice, spatial justice, as well as their intersections with regional histories in the US/Mexico borderplex.

The course will provide the infrastructure, computational environmental analysis, and computational design methodology for students of both campuses to identify and mitigate pressing health concerns in desertified urban environments. Students will design and prototype novel radiation-mitigating architectural assemblies, using advanced fabrication and material assemblies to provide protective public shade addressing the unique challenges of an urbanized desert environment, including considerations for sky exposure to reduce levels of ultraviolet radiation within conditions of apparent shade.

The course pedagogy will center around **four modules**, with instruction at each stage by course coordinators, informed by and punctuated with focused conversations with interdisciplinary experts and community partners through a parallel **studio seminar**.

Module 1. Computational Geospatial Investigations Over-Exposed Urban Shade (3 Weeks)
Detection, mapping, and identification of common patterns of spatial injustice due to high UV exposure.

Module 2. Computational Design – Radiation-Aware Structures (3 Weeks)
Translations of data towards spatial organizational strategies.

Module 3. Prototyping – Mitigating Material Assemblies (3 Weeks)
Materialization of radiation-aware structures through ecologically sensitive material explorations.

Module 4. Action – Public Interfaces (6 Weeks)
Deployment of projects in public space and public discussion.

Resources and Capacities
We are uniquely positioned to carry out the proposed course by utilizing resources in the POST (Project for Operative Spatial Technologies) research center, housed in the College of Architecture (CoA) at Texas Tech University's regional site in El Paso, TX, the only U.S. school of architecture located steps from the U.S.-Mexico border. POST is equipped with digital fabrication and rapid prototyping equipment, an extensive geospatial database including contiguous environmental and urban data spanning international and other jurisdictional boundaries in the US-Mexico borderland, geospatial analysis software and advanced computing equipment, as well as advanced imaging capabilities and environmental sensing equipment. Our team has developed several notable projects within the El Paso/Ciudad Juárez binational metroplex—and beyond—that leverage techniques of automation, sensing, visualization, and simulation to analyze, represent, predict, and operate within nascent conditions of spatial and environmental injustice, serving diverse publics. We work across disciplines with colleagues across architecture, urbanism, humanities, and environmental sciences.

The studio, based physically in the Texas Tech El Paso campus, will travel to the main university campus in

Lubbock, Texas, to access materials research and testing facilities relevant to the research at project benchmarks.

The course will advance the CoA's mission and leadership in the field to promote **innovation in sustainable design methods and pedagogies** in the context of climate change. The course will leverage the CoA's presence in multiple sites throughout the arid West Texas region, **bridging between CoA's Lubbock and El Paso campuses**. The course will leverage the unique context of the El Paso campus as the **only architectural school located on the US-Mexico border**, providing opportunities for **place-based learning** and **engaged scholarship** in a dynamic binational context. The course will provide a unique opportunity for students from the Lubbock and El Paso campuses to identify, explore, and address shared challenges between these two communities. The course will serve the majority-Hispanic student population at Texas Tech College of Architecture in El Paso, and the Texas Tech CoA population, recently ranked #3 nationally in architecture degrees awarded to Hispanic graduates (HispanicOutlook.com), and will seek to develop design strategies for the majority (85%) Hispanic population of El Paso, including disadvantaged communities of color in some of the poorest ZIP codes in the US.

Workplan

Summer 2023
Travel to main campus to meet with leading climate scientists, geographers, and spatial analysts and develop studio seminar.

Fall 2024
-Course Tools and Methods Development
-Studio Seminar Planning

Spring 2024
-Studio Conducted
-Student Travel Exchange (El Paso undergraduate students visit Lubbock, Lubbock graduate students visit El Paso)

Course Readings (selected)

Climate Change and the Borderlands
Fitzpatrick, Joan, Floyd Gray, Russell Dubiel, Jeff Langman, J. Bruce Moring, Laura M. Norman, William R. Page, and Jean W. Parcher. ***The Borderlands and climate change***: Chapter 10 in United States-Mexican Borderlands: Facing tomorrow's challenges through USGS science. No. 1380-10. US Geological Survey, 2013.

Wilder, Margaret, Gregg Garfin, Paul Ganster, Hallie Eakin, Patricia Romero-Lankao, Francisco Lara-Valencia, Alfonso A. Cortez-Lara et al. "***Climate change and US-Mexico border communities***." In Assessment of Climate Change in the Southwest United States, pp. 340-384. Island Press, Washington, DC, 2013.

Transboundary Health and Ecology
Pezzoli, Keith, Justine Kozo, Karen Ferran, Wilma Wooten, Gudelia Rangel Gomez, and Wael K. Al-Delaimy. "***One bioregion/one health: An integrative narrative for transboundary planning along the US–Mexico border***." Global Society 28, no. 4 (2014): 419-440.

Transboundary Governance
Ochoa Espejo, Paulina. ***On Borders: Territories, Legitimacy, and the Rights of Place***. Oxford University Press, 2020.

Payan, Tony, and Pamela L. Cruz, eds. ***Binational Commons: Institutional Development and Governance on the US-Mexico Border***. University of Arizona Press, 2020.

Deserts and Geopolitics
Henni, Samia, ed. **Deserts Are Not Empty**. Columbia University Press, 2022.

Journal of Architectural Education. 77:2. Deserts. Ersela Kripa, Francesco Marullo, Stephen Mueller, eds. (2023, forthcoming).

Lambert, Leopold, ed. ***Funambulist Magazine Vol. 44: The Desert***, 2022.

Shoshan, Malkit. **Desert Futures**.
https://www.desertfutures.org/

Spatial and Environmental Justice
Mbembe, Achille. **Necropolitics**. Duke University Press books, 2019

Nixon, Rob. **Slow Violence and the Environmentalism of the Poor**. Harvard University Press, 2011.

Ersela Kripa and Stephen Mueller. "**An Ultraviole(n)t Border**." e-flux architecture (Apr 2020). https://www.e-flux.com/architecture/at-the-border/325756/an-ultraviole-n-tborder/

El Paso/Ciudad Juárez History
Romo, David Dorado. 2014. **Ringside Seat to a Revolution**: An Underground Cultural History of El Paso and Juárez: 1893-1923. Cinco Puntos Press.