Arid Futures Exploratorium:
Community research institute for air, soil, and water

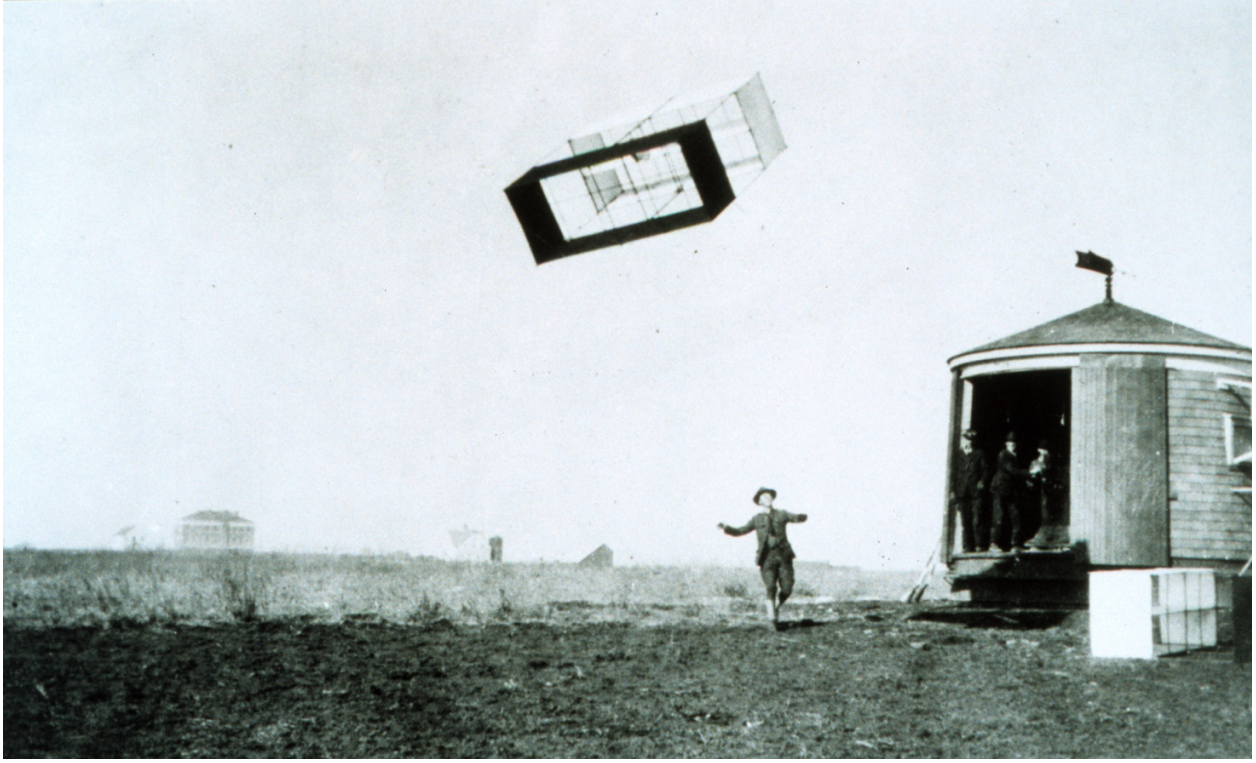


Image: Kite operations at an aerological station, from the NOAA Photo Library, 1900

ARCH 4602 - Architectural Design Studio VIII
6 Semester Credit Hours

Time: Mon/Wed/Fri, 1:00-4:50pm
Instructor: Dalia Munenzon
dalia.munenzon@ttu.edu
Office hours by appointment

Catalog Description:

Prerequisite: ARCH 4601. Provides instruction in advanced architectural design projects. Students develop integrated design skills as they negotiate the complex program, site, and form issues in a specific cultural context. Integrates aspects of architectural theory, building technology, and computation into the design process.

Course Brief

"Grass is what holds the earth together," writes Donald Worster in his historical accounts of the great plains 'cycles of aridity'. The terrestrial bond between aerosols, seeds, soil, and water forms this territory. In this unforgiving landscape, the depletion of the Ogallala Aquifer and projected climate will bring hotter, drier, and more unpredictable weather and jeopardize local ecosystems and communities. This premise provides an opportunity to explore, invent, and develop spatial imaginaries. We will design a proving ground to facilitate the connection between scientific research and local stewardship – to promote meteorological research, sustainable agricultural practices, and equitable community resilience.

Combining theory, scientific principles, architecture, and narrative construction will allow students to develop innovative spatial expressions. We will respond and focus on the relationship between the landscape, its flows, and the proposed program. Students will produce projective designs that will navigate the complexities of natural environments and user needs. What role will architecture take in a space designated to explore and anticipate these changing conditions? And how can we utilize design to connect and communicate meteorological and environmental research with thriving, sustainable economic practices?

The studio will offer a contemporary interpretation to the commons connecting ecological sensibility with stewardship. After analyzing the site, students will propose strategies and a master plan to locate and arrange the programs considering site conditions. We will collaborate with scientists from the TTU Department of Geosciences to develop a hub for learning and research - a space to measure and record the impacts of wind, aerosols, and drought. Structures for prototype landscapes, experimental climate-adapted agriculture practices where species will be hardened, monitored, and cultivated as a community farm. The Southern Great Plains' environment of shifting ground, self-sufficiency, remoteness, and at times sublime experiences - provides the optimal site to explore the relationship between its components. Design with the environment will require exploring adaptable and flexible spaces, the obsolescence and weathering of specific materials, and self-sustaining systems.

"Godhuli (গোধূলি) is thus the time of day when cows, with their hooves kicking up dust, return from pasture to their nightly refuge. The time of the day is so named because of the unique color caused by the conditions of light and dust. This word commingles light and dust, but also, importantly, color and texture."…

"Nephology, the branch of meteorology that studies clouds, confirms that we would also not have clouds without dust; water droplets need particulate matter to cling on to as they condense to form clouds. It naturally follows that there would be no rain without dust. In this manner, the universal logic of harmonious coexistence of antonymic entities is brought to fruition: rain could not occur without that which it washes away."

Text by Malcolm Sen and Image by Jonathan Dyck
from the edited volume *An ecotopian lexicon*, 2019
by Schneider-Mayerson, M., & Bellamy, B. R.

Dust, or aerosols, is an integral element of the local history, ecology, economy, sense of place, and weather cycles. As described by the Bengali loanword, Godhuli, it is part of the atmosphere of the inhabited environment. The processes of erosion, soil health, and depletion of water resources are often hard to grasp and are not tangible. Heat, dryness, daily weather registers physiologically, but scientific models that simulate the long-term process and systemic impacts are specialized and complex. By creating opportunities for the community to participate in the scientific observation and analysis process, sense and experience the natural flows, they can identify strategies and solutions for climate adaptive practices—understanding better natural processes to build reverence and responsibility towards the ecological systems. How can architecture accommodate these experiences? With similar goals, several initiatives explore these relationships between scientific research, experimentation, community, and stewardship, the most recent is the Climate Hub on Governors Island, NY. Other more science-focused examples are the DOE Atmospheric Radiation Measurement (ARM) user facility in the Southern Great Plains and the USDA Southern Plains Climate Hub. In this studio, we start from the idea of a technical research center and field station and expand that concept to include the environmental, cultural, and technological context with the provocation to explore architecture as the research instrument and sensory experience – and interpret the terrestrial process of aerosols as a communal space.

Studio Structure

The course will be organized as a studio; during the first seven weeks, the students will work on site analysis, topical research and will develop a site plan and a conceptual strategy. The second half of the studio will focus on developing and detailing the architectural design. Mon-Wed classes will be mainly desc crits and guest lectures; Fridays will be designated for pin-ups and reviews. As part of the weekly schedule, multiple guest lectures will address various issues related to the project progress – such as scientists from Geoscience, AgriLife, Soil, and community organizations.

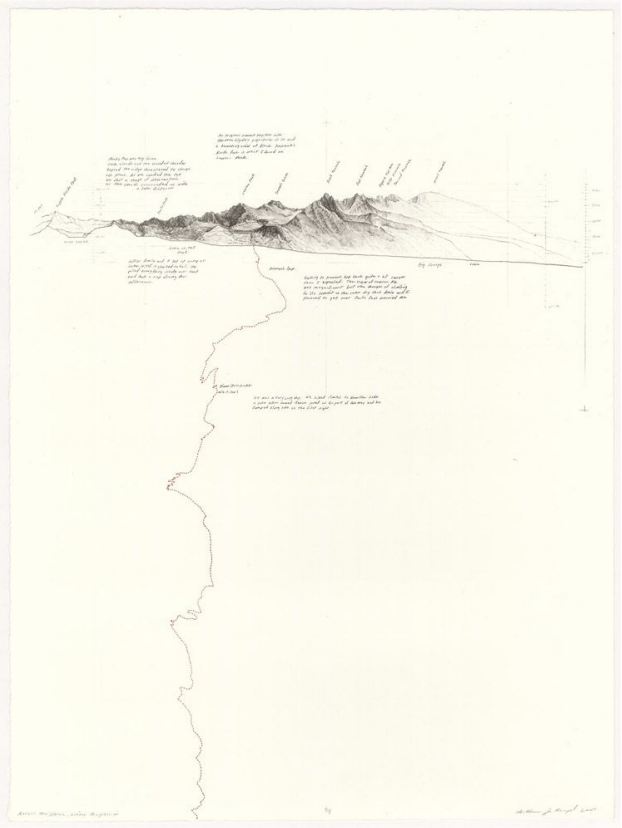
The semester and studio work will be divided into the following sections: Project 01, Context and Site Analysis; Project 02, Projective research and narrative development; Project 03, Proving grounds; Project 04, Concept to tectonics; Project 05, Final Documentation. Each section will have in-person pin-ups and online guest reviews. Final materials per each project must be presented and submitted to a shared studio folder. Assignment briefs, including digital documentation requirements, are provided at appropriate intervals during the semester (see schedule) for various design project phases. The semester's architectural design project will give the students practical challenges to explore issues stated in the course description and learning goals described in the NAAB Program and Student Criteria.

This breakdown will structure the project's development and conceptual foundation towards an architectural design. Projects 01-02-03 will help understand the complexities of the site and a specified program/typology, think through strategies to address climate and environmental issues across time horizons, learn to organize the site master plan and locate structures based on the spatial conditions and concept, and imagine how the scientific requirements can shape the program and influence architecture.

Project 01, Context and Site Analysis

The windy Amarillo and the adjacent Cross Bar Ranch (owned by the Bureau of Land Management (BLM) and managed with West Texas A&M University). The 12,000-acre Cross Bar Ranch land is explored as a recreation area (see the report from Amarillo.com).

The aim of Project 01 is to analyze the existing site, topography, weather, water and groundwater conditions, and cultural and social context to learn about the history and natural patterns and develop their conceptual approach. Students will collect environmental and planning information from City and County documents, economic plans and programs, and local community resilience and sustainability initiatives. In this phase, students will choose several site characteristics to study (History + Community, Geology + Climate projections, Ecology + Landscape, Buildings + Architecture, Agriculture + soil) and present at the end of two weeks. Each student will be asked to explore the selected subject through analysis and research to collect documentation for design, better understand the context, and express their impression of the site. The documentation process will explore ways of representation of findings, writings, and theory concerning the subject and the overlap with the project; this will support base materials for the class.



Guest reviewer - Prof. from the TTU Geoscience department will discuss considerations and introduce requirements for dust and meteorological research spatial analysis. Based on that input, the students will identify sites for interventions, field stations, and the research institute.

Image: Rangel Studio - Across the Sierra, Linear Progression, 2007, Lithograph

Project 02, Projective research and narrative development

Students will further research case studies of observatories, field stations, nature museums, farms, and approaches of landscape/ environmental scientific research and observation methods. This exploration aims to identify research tools to inspire the spatial experience and architectural elements.

Using the three case study categories: projects, instruments, theoretical pursuits - students will explore each case study for its objective/use, context and environmental history, basic argument, theoretical context, and scientific pursuit. The range of case studies will include

buildings, vernacular instruments, structures, utopian plans, and design techniques. Each case study will have a unique way to survey, observe, or intervene in the dynamic landscapes - the examples for potential focus areas: dust, materials, weathering, soil, groundwater, erosion, water, clouds, utilities and self-sufficiency, wind, habitat, etc. This inquiry will be accompanied by readings from architects and landscape architects (such as the work and writing of James Corner, SmoutAllen, Geoff Manaugh, Cedric Price, and others).

Students will synthesize the "instruments" selected with the site analysis into the project narrative - the guiding principle behind design decisions. Students will work with physical models and digital drawing techniques. The main deliverable will be an instrument or element in the site plan supporting the research program. The work will be iterative between research, physical models, and drawings.

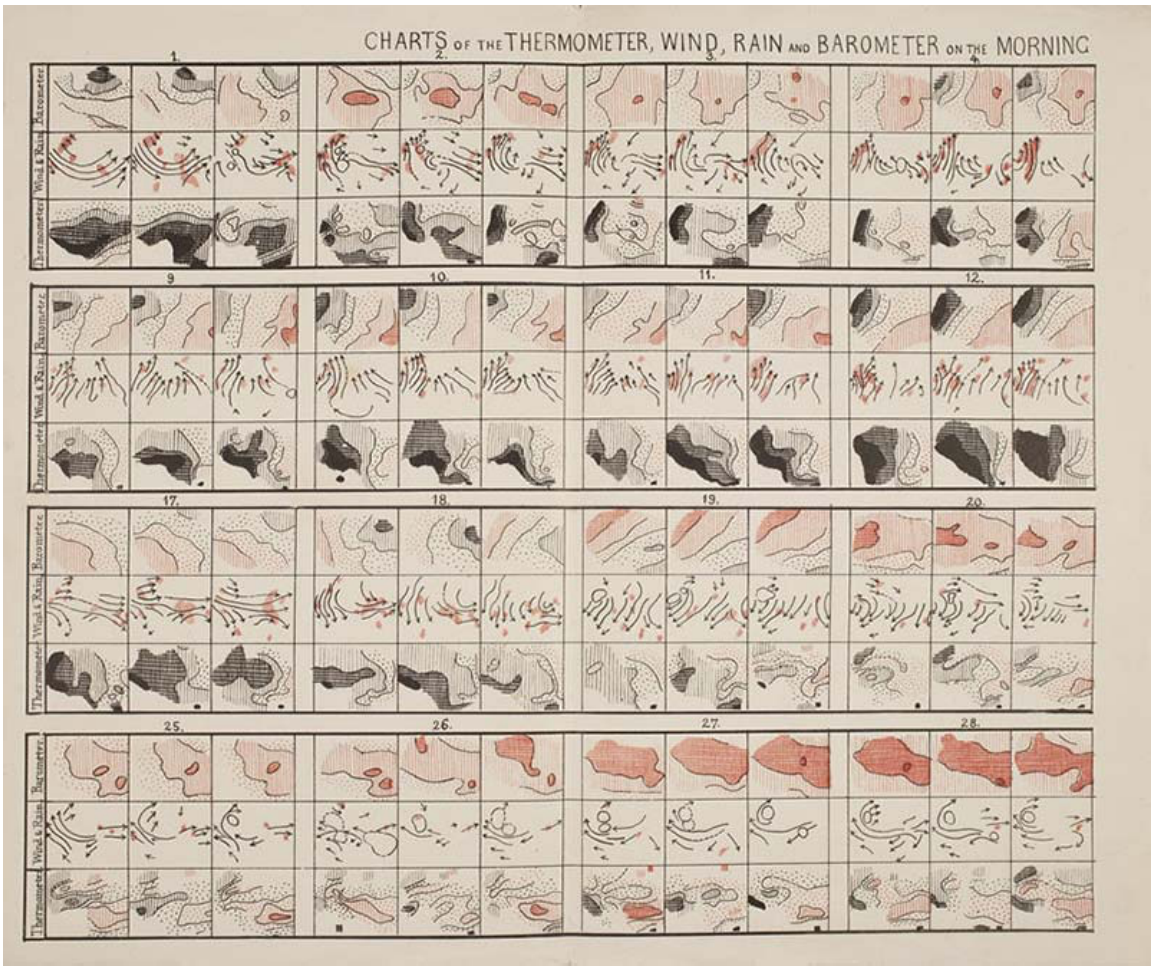


Image: Meteorographica, or Methods of Mapping the Weather, by Francis Galton (1863),
link - https://socksstudio.com/2014/05/11/meteorographica-or-methods-of-mapping-the-weather-by-francis-galton-1863/

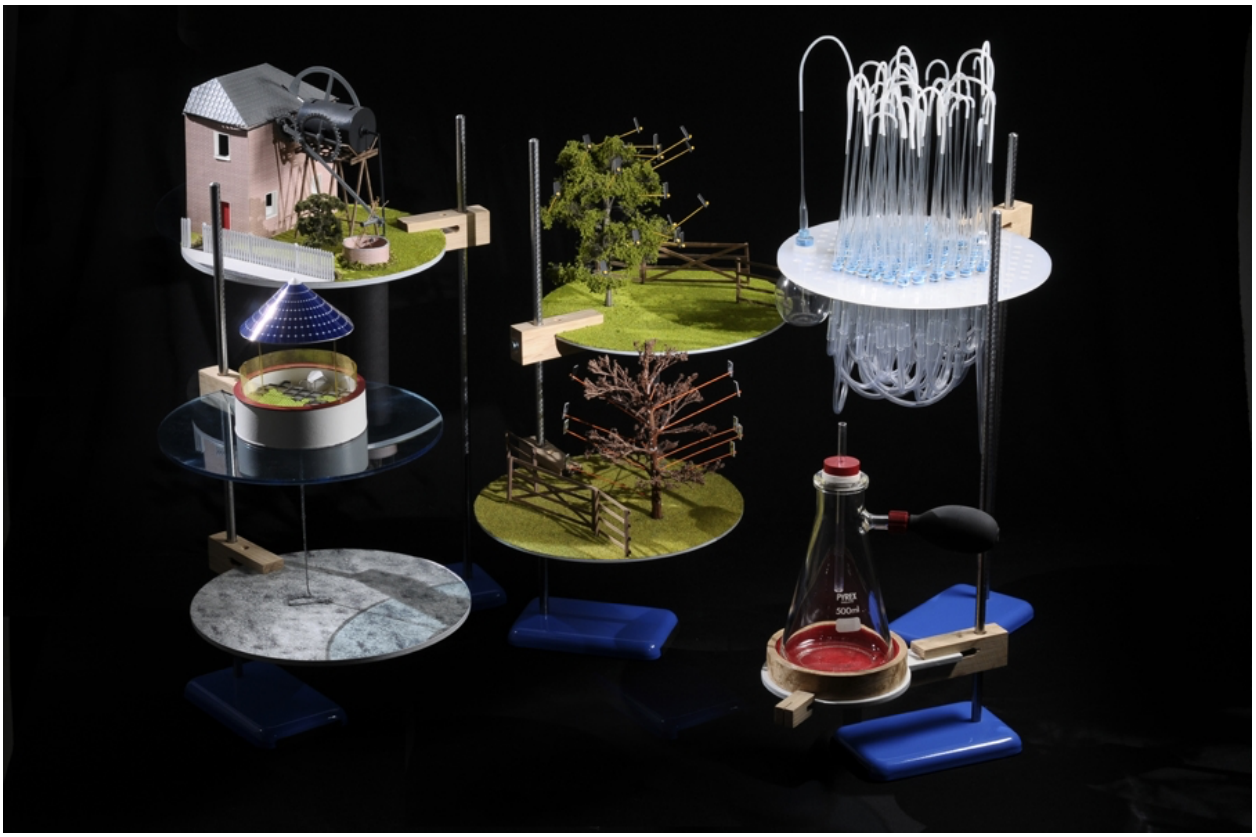
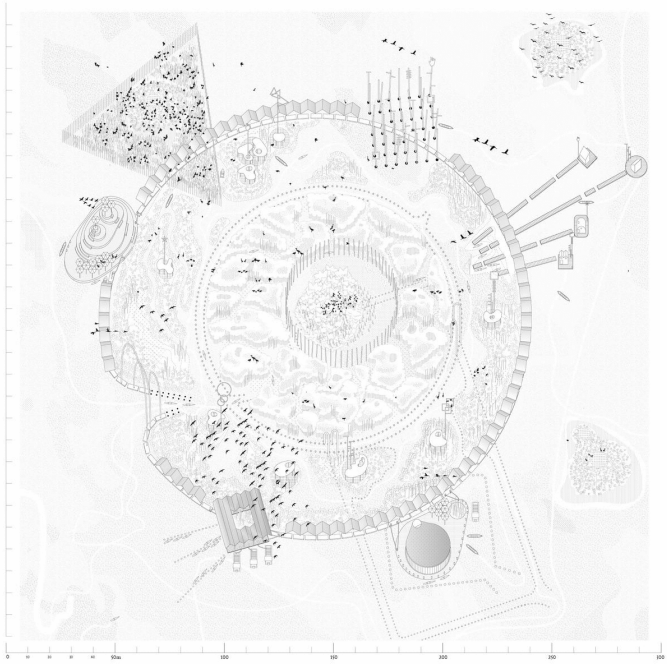


Image: Rae Whittow-Williams, 'Empirical Ecologies, Vulgar Visions' 2010 Bartlett

Project 03, Proving grounds

This section will formulate an argument/ narrative for a site master plan. Students will outline the relations between the programs and uses – what other strictures/field stations/ tools/ process/ landscape dynamics will be incorporated? How do these elements play a role in a greater plan of the proving ground? What do they measure/observe, and during what time of the year? Will this master plan change in a few years (potential phasing)? How will nature and the environment perform? How will the narrative respond to time (seasonal changes and the long-term future)? How will the community play a role? What is the planned visitor path and experiences?



The students will design a site master plan to combine recreation/playscape and education/scientific research. The master plan will explore the relationship between the programs and propose a preliminary strategy for the programs and buildings. The students will produce a master plan presenting the proposed distribution of activities with supporting diagrams (movements, programs, vegetation, etc.) and a section/ transect of important locations for the concept. Students will work with a physical topography model of the transect and site and digital drawings.

Image: The Design of the Encounter, Studio Ossidiana – http://www.studio-ossidiana.com/the-design-of-the-encounter

Image: Samantha Lee, AA Diploma 6: "Sacred Anomalies: Infiltrating Landscape Surveys"- link http://pr2012.aaschool.ac.uk/students/samantha-lee

Project 04, Concept to tectonics

Based on the findings and concepts studied in Projects 01-02-03, students will develop the design of the Exploratorium components – the meteorological research facility, experimental structures, caretakers and researcher lodging, field stations, and recreational park structures. This period will be dedicated to learning strategies and techniques for developing form, structure, enclosures, and performative elements to measure and observe

natural processes through the design of components. Students will be asked to produce drawings and physical models to support and communicate their strategy.

Concept
The early research will define the architectural concept and the environmental process and analysis approach. In project 04, the students will work on the building design while remaining true to the idea. A compelling and straightforward narrative will be critical to the strength and success of the project.

How is the history and community of the city reflected in the choice of materials and architecture? How the dynamics of nature are invited into the building. Which areas or design elements can be flexible and adaptable? What components of the design can play a role in the program as a research instrument/architectural device?

Form and Space
Understand the relationships between the community and research spaces, the scales of the user, the group, instruments, and the site. Develop architectural ideas of open-ended spaces, integrating natural acclimatization, community ownership, and stewardship. Design for activities and senses to expand traditional notions of apertures, rooms, and structures through abstraction of uses. Develop circulation and auxiliary spaces with attention to transition and multi-use spaces. Spaces will need to provide full accessibility to public spaces.

Site design
The landscape and environment are inseparable from the experience of the site. The students will detail the intersection between the surroundings and the architecture (horizontally and vertically).

Materials and building technology
Which materials will manage best for the strong winds and dryness, increase in heat, And other future climate conditions? How do these materials serve the concept? Where are the materials sourced from, and how do they relate to the site's history? And how will these materials weather and age? The class will review precedents and discuss various approaches and schools of thought regarding materials and sustainability.

Sustainability and self-sufficiency
The structures and programs will need to be self-sufficient and based mostly on renewable energy. The spaces will need to be naturally ventilated with minimal use of climate control. Structural systems, envelopes, and enclosure systems will be designed to serve the concept. Structures as field stations will need to be light and potentially movable or mutable. How can the site and building design support and minimize the transit of stuff? What can be sourced locally, and what will be grown on-site?

Project 05, Final Documentation

Production of final drawings and models with compilation to a final document. Materials from all phases will be submitted to OneDrive and Miro Board. Drawings and models should be produced with dexterity, a high level of care and craft, and demonstrate detail, rigor, and precision. Architectural drawings should comply with graphic standards and

conventions and accomplish high legibility, creativity, and clarity. Class graphic standards and templates will be shared at assignment introductions; all drawings created and shared in-studio will be required to follow these standards.

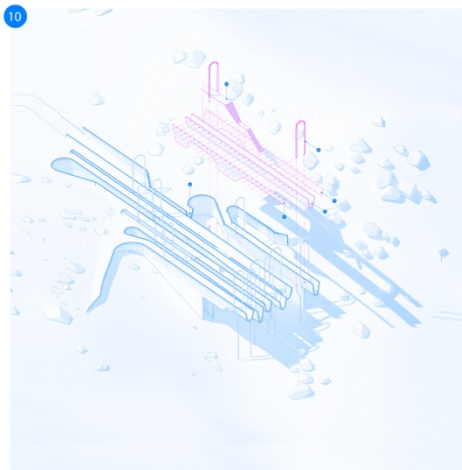


Image: Winery Without Rainfall - Daniel Marshall, MIT

Course Schedule (TBD)

Dates are subject to change in case of unforeseen events or in relation to studio progress.

	Sunday	Mon	Tue	Wed	Thurs	Fri	Saturday
Week 1	09 January	10	11	12 all school meeting – studio lottery	13	14 Studio Introduction First mini-Assignment (Project 00)	15
Week 2	16	17 MLK Day – no class	18	19 **Introduction to Project 01** **Pin-up – Project 00**	20	21 Desk crit	22
Week 3	23	24 Lecture (TBD)	25	26 Desk crit	27	28 **Project 01 Pin-up**	29
Week 4	30	31 **Project 02 Introduction Lecture** CoA lecture: Charles Davis II (Princeton)	01 February	02 Desk crit	03	04 **Project 01 Review and 02 Pin Up**	05

Week 5	06	07 Lecture & Desk crit	08	09 Desk crit	10	11 Project 02 Review	12
Week 6	13	14 Project 03 introduction Lecture CoA lecture: Viola Ago (UCLA)	15	16 Desk crit	17	18 Project 03 Pin Up	19
Week 7	20	21 Desk crit	22	23 Desk crit	24	25 Project 03 Review	26
Week 8	27	28 Project 04 introduction Lecture	01 March	02 Desk crit	03	04 Project 04 Pin Up	05
Week 9	06	07 CoA lecture: Chris Cornelius (UNM)	08	09 Desk crit	10	11 Mid-review All	12
Week 10	13	14 Spring Break no class meetings	15	16 Spring Break no class meetings	17	18 Spring Break no class meetings	19
Week 11	20	21 Lecture	22	23 Desk crit	24	04 Project 04 Pin Up	26
Week 12	27	28 Desk crit	29	30 Desk crit	31	01 April Project 04 Pin Up	02
Week 13	03	04 Desk crit	05	06 Desk crit	07	04 Project 04 Pin Up	09
Week 14	10	11 CoA lecture :Ted Flato (Lake/Flato)	12	13 Desk crit	14	15 Penultimate Project 04 Review	16
Week 15	17	18 University holiday–no class meetings	19	20 Desk crit	21	22 All studio work due - final documentation project 5	23

Week 16	24	25 Final reviews week	26	27	28	29	30
Week 17	01 May	02 Last Day of Classes					

Image: ABU DHABI / Weatherfield, LCLA – link https://www.luiscallejas.com/ABU-DHABI-Weatherfield

References

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Schneider-Mayerson, M., & Bellamy, B. R. (2019). An ecotopian lexicon.

Smets, Marcel. "Grid, Casco, clearing and montage" in Topos vol. 38, About Landscape Edition (Basel: Birkhaüser, 2002). Pgs 88–101.

(Issuu) Smout- Allen , Envirographic and Techno Natures by Smout Allen, https://issuu.com/bartlettarchucl/docs/smout_allen_02_techno_natures_s05_u

(Video) Strandbeesten: Lifelike, wind-powered creatures, https://youtu.be/Bxlwn5zqdmk

Powell, J. W., Gilbert, G. K., Dutton, C. E., Thompson, A. H., Drummond, W., & Geographical and Geological Survey of the Rocky Mountain Region (U.S.). (1879). Report on the lands of the arid region of the United States: With a more detailed account of the lands of Utah : with maps. Washington: Government Printing Office.

Vignjevic, A. (April 15, 2017). Dialectic Atmosphere of Architecture: on Aesthetic Experience and Meteorology. Am Journal of Art and Media Studies, 12, 41.

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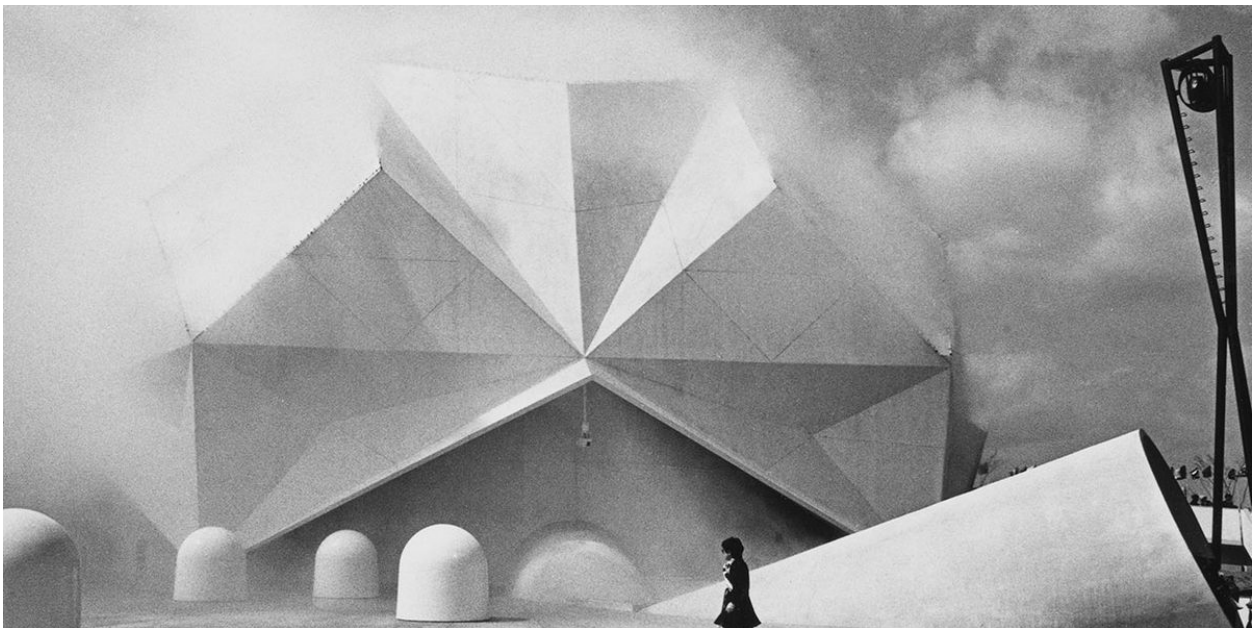

Image: Fujiko Nakaya Pepsi Pavilion, Expo '70, Osaka
Link - https://spectrum.ieee.org/when-artists-engineers-and-pepsico-collaborated-then-clashed-at-the-1970-worlds-fair

Resources

Site analysis resources

Encyclopedia of the Great Plains
http://plainshumanities.unl.edu/encyclopedia/intro.html

Geologic Atlas of Texas
https://www.twdb.texas.gov/groundwater/aquifer/GAT/index.asp

Texas historic maps – UT Austin
https://maps.lib.utexas.edu/maps/atlas_texas/index.html

Nature Conservancy
https://www.nature.org/en-us/about-us/where-we-work/priority-landscapes/central-great-plains-grasslands/

Texas Land Conservation Assistance Network
https://www.texaslandcan.org/High-Plains/Water-Resources/

The Climate Reality project
https://www.climaterealityproject.org/blog/how-climate-crisis-affecting-great-plains

Climate resilience toolkit
https://toolkit.climate.gov/regions/northern-great-plains

Potter County Commissioners' Court passes measure in favor of development of Cross Bar Ranch
https://www.amarillo.com/story/news/2021/04/12/cross-bar-ranch-potter-county-development-commissioners-court/7186986002/

Degrees of Change: How Much Climate Change has Warmed Amarillo's Weather
http://www.highplainsgardening.com/amarillo-degrees-change-how-much-climate-change-has-warmed-amarillos-weather

Community

Amarillo Comprehensive Plan
https://www.amarillo.gov/departments/planning-and-development-services/planning/adopted-plans-policies

Amarillo- sustainability goals
https://www.amarillo.gov/departments/planning-and-development-services/public-works/solid-waste-collection-disposal/recycle/sustainability

High Plains and Garden Food Bank

https://www.hpfb.org/the-garden

2016, Refugee communities in Amarillo
https://www.texasmonthly.com/articles/refugees-amarillo-texas/

2019, These Rural Panhandle Towns Should Be Shrinking. But Thanks To Immigrants, They're Booming.
https://justiceandunity.emersoncollective.com/the-panhandle-boom

Food Forest Atlanta
https://modernfarmer.com/2021/02/atlanta-has-created-the-largest-free-food-forest-in-the-country/

Meteorological tools

Timeline of meteorological tools:
https://www.sciencelearn.org.nz/interactive_timeline/9-measuring-the-weather-a-timeline

NOAA weather Observations
https://www.noaa.gov/education/resource-collections/weather-atmosphere/weather-observations

Agriculture

KU and the Land Institute
http://today.ku.edu/2017/06/13/researchers-team-land-institute-boost-perennial-permaculture-native-fungi

Tallgrass prairie
Timothy A. Schuler, "The Middle of Everywhere," Places Journal, November 2019
https://doi.org/10.22269/191112

Lenora Ditzler's Pixel farming
https://youtu.be/jI9Gi4p3Xm8

AP - Farmers restore native grasslands as groundwater disappears
https://apnews.com/article/business-science-environment-and-nature-texas-aquifers-db7cc8b855ac2e0f7b184d36ac716346

West Texas drought resilience farming
https://www.farmers.gov/blog/disaster-planning-and-assistance/fridays-farm-building-drought-resilience-continue-ranch

Humanity's Most Problematic Attempts to Get All the Water By Yvonne Bang On Jun
https://nautil.us/blog/we-suck-humanitys-most-problematic-attempts-to-get-all-the-water

Vegetations research methods

Austin Experimental forest
https://www.srs.fs.usda.gov/4159/experimental-forests/stephen-f-austin/

USDA Arid carbon research
https://www.fs.fed.us/research/highlights/highlights_display.php?in_high_id=832

Trees in extreme heat
https://www.scientificamerican.com/article/trees-sweat-to-keep-cool/

Japan's experimental forests
https://www.global.hokudai.ac.jp/about/facilities/experimental-forests-and-farms/

Soil temperature testing Harvard Forest
https://jgi.doe.gov/csp-2019-short-term-temperature-shift-harvard-forest/

Proving Grounds

DOE's Atmospheric Radiation Measurement (ARM)
https://www.arm.gov/tour/southern-great-plains.html

USDA Southern Plains Climate Hub
https://www.climatehubs.usda.gov/hubs/southern-plains

University of Florida, Lightning research group
http://www.lightning.ece.ufl.edu/

Mississippi River Basin Model
https://placesjournal.org/article/the-scale-of-nature-modeling-the-mississippi-river/?cn-reloaded=1