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LANDSCAPE DESIGN THAT ENHANCES SOCIALIZATION AND COMMUNITY THROUGH CLIMATE RESILIENCE GUIDELINES FOR NORTH TEXAS UNIVERSITIES.

By

MELISSA N. BROWN

Presented to the Faculty of the Graduate School of
The University of Texas at Arlington
in Partial Fulfillment of the Requirements for
the Degree of

MASTER OF LANDSCAPE ARCHITECTURE
THE UNIVERSITY OF TEXAS AT ARLINGTON

MAY 2024

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were taken/created by the author.

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There are men at UTA, and I have grown to enjoy my lively disagreements and discussions with Dr. Ozdil and Professor Hopman. Professors Klahr, Chiessa and Bijan Youssefzadeh, though not my professors, were friendly, approachable and would engage with me in impromptu discussions on random topics; their friendly attitude reinforced the community feel of CAPPA. Small acts of kindness have immeasurable value.

We are diverse but together we are a sum greater than our parts.

May 8, 2024

Abstract

LANDSCAPE DESIGN THAT ENHANCES SOCIALIZATION
AND COMMUNITY THROUGH CLIMATE RESILIENCE
GUIDELINES FOR NORTH TEXAS UNIVERSITIES.

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The University of Texas at Arlington, UTA

Supervising Professor: Diane Jones Allen

Landscape architects must balance social, economic, and environmental considerations while creating places that people will love. And, in the words of American Society for Landscape Architects Fellow Mary Margaret Jones: “If we don’t make places people love, they won’t be taken care of”. (ALSA Interview, n.d.) Consideration for the user experience will result in spaces that people are more likely to love.

The growing student population at the University of Texas at Arlington means that every space must be used to its full potential. The green and open spaces on a university campus are more than circulatory routes between buildings. University campus landscapes form some of the first impressions a student or faculty member will make and can influence whether the university is viewed positively. University campus landscapes can positively impact users’ physical and mental health as well as improve performance. And they provide ecological services such as absorbing and filtering stormwater, absorbing carbon dioxide and filtering pollutants, reducing ambient temperatures, and providing food and habitat for local fauna. Because these spaces face threats from weather extremes caused by climate change, climate resilience should be a consideration when designing a landscape.

While climate resilience is itself a worthy pursuit, this thesis focuses on the benefits of socialization and community that effective landscape architecture will optimize. In recognition of the legacy of effective and ineffective landscaping actions at the University of Texas at Arlington over the last forty years, this thesis also provides a guide via a

series of matrices demonstrating how one green space at the campus may dramatically achieve social, economic, and environmental sustainability. These matrices are provided in an appendix in the form of a Socially Active Climate Resilient Landscape Matrix to aid UTA and other universities in achieving these benefits.

Table of Contents

Contents

Acknowledgements	iii
Abstract	iv
Table of Contents.....	vi
Tables and Figures	viii
1. Introduction.....	1
1.1. Background.....	1
1.2. Problem Statement	2
1.3. Research Questions / Design Question	3
1.4. Definition of Terms	3
1.5. Statement of Purpose	5
1.6. Methodology	6
1.7. Significance	6
1.8. Research Delimitations	7
1.9. Limitations	7
2. Literature Review	8
2.1 Introduction	8
2.2. Climate Change	9
2.2.1. Climate Change in North Texas	9
2.2.2. Climate Movement	9
2.2.3. Campus Landscapes & Climate Change.....	10
2.3. Human Behavior.....	11
2.3.1. Safety.....	12
2.4. Campus Landscapes.....	12
2.5. Climate Resilient Landscapes.....	13
2.6. Case Study Location.....	14
2.7. Horticulture.....	16
3. Research Methods	18
3.1 Methodology	18
3.2. Precedent Studies	19
3.3. Interviews	21
3.4. Socially Active Climate Resilient Landscape Matrix.....	22
3.5. Survey.....	22
3.6. Observation	23
3.7. Conclusion.....	23
4. Site Selection	25
4.1. Site Selection Methodology.....	25
4.2. Observation	27
4.3. Matrix Results.....	29
5. Analysis.....	34

5.1.	Precedent Study Analysis.....	34
5.2.1.	University of Texas at Dallas	34
5.2.2.	Arizona State University	34
5.2.3.	Georgia Institute of Technology	35
5.2.	Case Study Analysis	35
5.3.	Observational Analysis	35
5.4.	Survey & Interview Analysis	36
5.5.	Site Analysis	37
5.6.	Strengths, Weaknesses, Opportunities, & Threats	42
6.	Design	43
6.1.	Introduction	43
6.2.	Socially Active Climate Resilient Landscape Design.....	44
6.2.1	Walkways, Bioswale & Linear Fountain	45
6.2.2	Plant Palette.....	46
6.2.3	Shaded Courtyard, Fountain & Berms.....	47
6.2.4	Sculptural Skatepark	48
6.2.5	Tables	49
6.3.	Conclusion.....	49
7.	Conclusion	51
7.1.	Research Questions Revisited.....	51
7.2.	Test.....	51
7.3.	Future Research	52
7.4.	Relevance to Landscape Architecture	52
	Appendices	57
	Appendix A: Internal Review Board: Approval.....	57
	Appendix B: Interview Cover Letter	58
	Appendix C: Condensed Minimal Risk Consent Form.....	59
	Appendix D: Socially Active Climate Resilient Landscape Design Matrix	61
	Bibliography.....	65

Tables and Figures

Figure 1-1 The purpose of the Study.....	5
Figure 2-1 Literature Review Topics	8
Figure 2-2 UTA Relation to the DFW Metroplex	14
Figure 2-3 Location of UTA Within Arlington	14
Figure 2-4 UTA in Relation to Major Roads	14
Table 2-5 Function, Aesthetic, & Environmental Considerations (IFAS, n.d.)	16
Figure 3-1 Methodology Flowchart	17
Figure 3-2 Precedent Site Affiliations & Accolades	19
Figure 3-3 Sustainable Features.....	20
Figure 3-4 Socially Active Climate Resilient Landscape Matrix Rating System	22
Figure 3-5 Socially Active Climate Resilient Landscape Matrix Inspiration.....	24
Figure 4-1 Notable Open Green Spaces on UTA Campus.....	25
Figure 4-2 Site Selection Methodology	26
Figure 4-3 CAPPa Courtyard (1), Library Plaza (3) & Greene Research Quad (4).....	26
Figure 4-4 Library Plaza	27
Figure 4-5 Library Plaza Ethnogram	27
Figure 4-6 CAPPa Courtyard	27
Figure 4-7 CAPPa Courtyard Ethnogram	27
Figure 4-8 Greene Engineering Quad one year after Construction.....	28
Figure 4-9 Greene Research Quad Ethnogram	28
Figure 4-10 Socially Active Climate Resilient Landscape Matrix: Design	30
Figure 4-11 Socially Active Climate Resilient Landscape Matrix: Human Behavior & Site Furnishings	31
Figure 4-12 Socially Active Climate Resilient Landscape Matrix: Trees & Landscape Conditions.....	31
Figure 4-13 Socially Active Climate Resilient Landscape Matrix: Climate Resilience	32
Figure 5-1 Passive Observational Data.....	35
Figure 5-2 Site Context	37
Figure 5-3 Engineering and Research Quad as Designed	37

Figure 5-4 Engineering and Research Quad Site Analysis.....	38
Figure 5-5 Image Context Map	40
Figure 5-6 ERB Entry.....	40
Figure 5-6 ERB Breezeway: No Amenities	40
Figure 5-7 Windows at ERB: No Seating.....	40
Figure 5-9 Entrance to Nedderman Hall & Maintenance Vehicle	41
Figure 5-10 Nedderman Hall Entry: No Seats	41
Figure 5-11 Pedestrian Mall: Unhealthy Trees & Maintenance Vehicle	41
Figure 5-12 View to Cooper St & Parking Lot.....	41
Figure 5-13 Xeric Garden: Mostly Weeds.....	41
Figure 5-14 View North on Pedestrian Mall & Vehicle	41
Figure 5-15 View Northeast from Table	41
Figure 6-1 Concept.....	43
Figure 6-2 University of Texas at Arlington: Vision, Values, Mission & Strategic Themes (UTA, n.d.).....	43
Figure 6-3 Redesigned, Socially Active, Climate Resilient Greene Quad	44
Figure 6-4 Current Gateway to the Engineering Quad	45
Figure 6-5 Enhanced Gateway to the Engineering Quad	45
Figure 6-6 Eye of UTA Shaded Courtyard.....	47
Figure 6-7 Skatepark Inspiration by Spohn Ranch.....	48
Figure 6-8 Skatepark in Southern Portio of Quad Looking North at ERB	48
Figure 6-9 Issues Addressed Through New Design	50
Figure 7-1 Human & Site Furnishings Results	54
Figure 7-2 Design Metric Results	54
Figure 7-3 Environmental Conditions: Tree Health	55
Figure 7-4 Environmental Conditions: Landscape & Climate Resilience.....	57

1. Introduction

*Ere the planter undertakes his toil,
Let him examine well his clime and soil,
Patient explore what best with both will suit,
And, rich in leaves, luxuriantly shoot.
For trees, unless in vigorous health they rise,
Can ne'er be grateful objects to the eyes.*

(R.P. Knight, *The Landscape* [London, 1795])

1.1. Background

The excerpt from the poem “The Landscape” illustrates the impetus for the focus of this thesis; landscapes where the plants are not healthy will not be nice to look at. Hence, one should consider the climate, soil, and other site conditions before choosing what to plant. The extreme weather patterns of climate change make it even more important to consider sun, cold, heat, moisture, and flood tolerance.

Universities rely on outdoor spaces to carry out many of their major functions. The spaces between university buildings function as more than just circulation; these areas are places to study, relax, to stimulate curiosity and for aesthetic pleasure. (Marcus & Francis, 1998) Studies have shown a strong correlation between campus green spaces and student mental and physical health as well as academic achievement. (Liu, 2022)

Although the University of Texas at Arlington (UTA) is the number one public school in DFW, best public university for veterans and one of the top three colleges in Texas for improving social mobility, (UTA.edu) the campus landscape is not yet ranked among the top performers. It is not a destination. We are living in the Anthropocene, an epoch characterized by human involvement. (Pavid, n.d.) In an interview with the American Society of Landscape Architects, Mary Margaret Jones, president of Hargreaves Jones and American Society of Landscape Architects

(ASLA) Fellow, said that her firm creates “places people will love” which result in economic stewardship. (ALSA Interview, n.d.) People take care of places they love. Therefore, one should consider the human element when designing spaces. What attracts people to, and causes them to spend time in a place?

1.2. Problem Statement

Over the next ten years the University of Texas at Arlington is expected to see a 29.86% increase in enrollment. (Master Plan, 2023) As a university in the middle of urban environment, UTA has little room to expand and must use existing space wisely. The multidisciplinary design firm SmithGroup is leading the creation of a new Master Plan which began in 2023 and should be completed by the end of 2024. Results from a preliminary analysis completed in 2023 indicate that UTA needs more spaces for interaction and an iconic outdoor green space. (Master Plan, 2023)

In addition to the challenge of creating space for its growing population, the university must also adapt to face the threats of climate change. The Office of the Texas State Climatologist reported that the average temperature in Texas is expected to be 3°F warmer in 2036 than that of the second half of the 20th century. (Nielsen-Gammon et al, 2021) Precipitation amounts are expected to be variable. These extreme weather patterns and trends often make it uncomfortable or even unsafe to be outside or in a building that does not have adequate heating and cooling. (CDC, 2022) According to the Climate Vulnerability Index, the zip code 76109 where UTA is located is in the 77th percentile of vulnerability to environmental factors which can be a threat to the communities’ well-being. It is in the 51st percentile for climate vulnerability and the areas directly to the north and east of the campus are in the 82nd and 83rd percentile. The National Noise Prevention Map lists noise levels at UTA in the 92nd percentile and 62nd regarding traffic proximity and volume. (Climate Vulnerability, n.d.)

Historical weather patterns, compounded by climate change, are trending toward extreme weather events that magnify the already unique challenges for landscaping in North Texas. These extreme trending weather events might include an increase of severe thunderstorms, hail, wildfire, flood, intense precipitation, and drought. (Nielsen-Gammon et al, 2021) Variables such as population and development and developments in agriculture also factor into drought and flood predictions. Over the last few years, portions of the landscape on the University of Texas Arlington campus have had plants that were installed, died, and been replaced. Azaleas, which are better suited to areas of the country with acidic soil and less temperature extremes (American Rhododendron Society, n.d.), were

planted then slowly died; in their place, only struggling Asian jasmine remained. Heavy rains, prolonged droughts, and an increasing number of days with record breaking heat have only made it harder for plants poorly suited to the climate to survive. (Creech, 2023) The Campus Green, which opened with a lot of publicity in 2012, is now weedy and neglected. Indian Hawthorn across the campus froze in the winter of 2021 and were subsequently replaced with new Indian hawthorns. In contrast, the native plants on campus, including those maintained, designed, and installed by landscape architecture students under the guidance of Professor David Hopman and his students continue to thrive. Native plants, by virtue of evolving in the area where they naturally occur, are adapted to the weather and precipitation amounts of the regions where they are found. (Native Gardening, USDA.gov)

In addition to climate threats there are several pathogens which threaten common landscape plants. Roses, which up until recently were used in mass plantings throughout DFW, have died or are declining and need to be removed. (Sperry, 2022) Many trees that are not native to DFW and were planted in large numbers have declined over the years leaving missing, dead, or split trunks in their place decreasing the canopy cover and increasing the urban heat island. Unkept landscapes with dead or dying plants not only look bad but can negatively affect student enrollment. (APPA, 2021)

1.3. Research Questions / Design Question

This research sought to answer the following question; how can campus landscape design positively address the design principles for both social interaction and climate resilience? To answer that question research was conducted to learn what the guidelines are for a climate resilient landscape in North Texas; and what are the design principles for socially active outdoor spaces that are best suited for a college campus?

1.4. Definition of Terms

- **Bioswale:** A long trench or channel which is a type of green infrastructure that collects, filters and slows rainwater runoff through organic matter and vegetation. (Merriam-Webster, n.d.)
- **Campus Quad:** A quadrangle, or “quad” for short, is a typology associated with universities and colleges and is largely defined by their rectilinear shape and the presence of large buildings at the perimeter. Occasionally a campus will have a space which is symbolic of a traditional university

quadrangle even if it does not meet the strict definition. The primary purpose of a quad is a space for community and socialization. (Compass Academics, 2022)

- **Climate Resilient Landscape:** A landscape which can maintain the ecological functions it was designed for, contains vigorous native biodiversity, achieves important functions despite changing conditions and stressors. (Beller et al., 2018)
- **Ethnography:** A qualitative method for gathering information used in social and behavioral sciences. (University of Virginia, n.d.)
- **Ethnogram:** Combines the Greek prefix “ethno”, or people (Merriam-Webster) to the Greek “suffix”, which translates as something written or drawn. (Dictionary.com, n.d.) Together an ethno-gram is a chart or graph recording the movements and demographics of a group of people in a set location.
- **Green Infrastructure:** An alternative to gray infrastructure (which uses system of pipes and tunnels to move stormwater to a treatment plant), green infrastructure filters and absorbs runoff at the site. (Green Infrastructure, n.d.)
- **Matrix:** Information arranged in a rectangle which is used to measure something. (Cambridge University, n.d.)
- **Plant Hardiness:** Ability of a plant to survive extreme weather conditions such as cold and drought. (Nielsen-Gammon et al, 2021)
- **Polyculture:** A mixture of different plants genera in a landscape. A polyculture increases the resilience of a landscape by increasing its ability to cope with changes to growing conditions. As average temperatures rise some species may struggle while others thrive. Finally, polycultures increase biodiversity and therefore increase ecological benefits. (City of Cocoa, n.d.)
- **Resilient Landscapes:** recover more quickly from extreme events such as fire, flood, and drought. (King, n.d.)
- **USDA Plant Hardiness Map:** This map is used as a guide to determine if a plant will survive an average winter in a particular zone. It lists a range of expected cold temperatures. This map was recently updated to reflect the changing climate. (USDA, n.d.)
- **SITES Certification:** Sites certification was developed in partnership with the United States Botanic Gardens, the Lady Bird Johnson Wildflower Center, and ASLA. It was modeled after the U.S. Green

Building Council's LEED® Green Building Rating System and is now managed by the Green Business Certification Inc. (Lady Bird Johnson Wildflower Center, 2018)

- **Sustainable Plants:** A plant that is sustainable is one that does not have noteworthy pathogens, is drought resistant, has a long lifespan, and is not invasive. These plants require less resources such as fertilizer, supplemental irrigation, pesticides. (UMA, 2016)
- **Sustainable Landscape:** those that actively contribute to healthy communities, are regenerative and responsive to the environment; they also sequester carbon, restore habitats, clean the air and water, increase energy efficiency and through significant economic, social, and environmental benefits create value. (ASLA, 2017)

1.5. Statement of Purpose

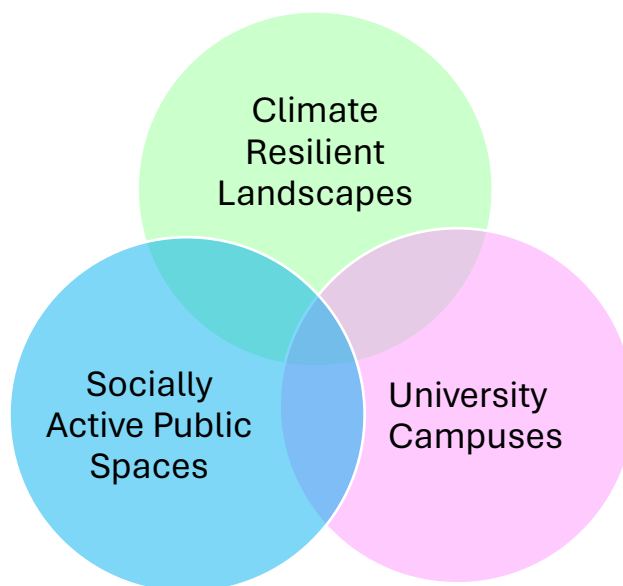


Figure 1-1 The purpose of the Study.

The primary goal of this thesis is to find the impediments to successful climate resilient socially active outdoor landscaped spaces at UTA and provide the necessary tools and information to equip them to succeed. The tools proposed are a set of guidelines which can be used to determine whether an open space on campus fosters socialization and is resilient to the threats of climate change. This guideline will be used to examine existing landscapes and to influence and assess the redesign of a part of the campus which was shown to have the lowest score under this rubric.

1.6. Methodology

A mixed methodology, which involved both quantitative and qualitative research was used to gather data. The quantitative data was gathered from a literature review and precedent studies. Qualitative information came from on-site observations, surveys, expert interviews and virtual and in person master and climate action plan meetings.

The information gathered is based on recommendations for sustainable landscapes from related industry organizations such as ASLA, Second Nature, various climate action plans, and horticultural professional agencies including the Texas A&M AgriLife Extension Service.

Precedent studies were used to collect quantitative data from campuses which have transitioned, at least in part, to sustainable landscapes. Interviews were conducted with landscape, horticulture and maintenance professionals involved in selected universities to collect a wide range of qualitative data.-A Campus and Community Climate Resilience assessment created by Second Nature was also used as guidance.

1.7. Significance

The implementation of the guidelines created by this research will result in a more socially active campus landscape which will be better suited to weather the challenges the north Texas climate poses.

A university with a greater amount of well executed landscapes can achieve multiple benefits. Such a university is more likely to attract and retain students and staff and improve fundraising potential. They are also better able to advance programs related to education and research and function as a community asset. (Dober, 2000) According to Nature Restoration Theory, the benefits of views of nature extend beyond restoring mood to increase sustained attention and decrease errors in tasks completed after viewing landscaped areas – be it a park or a green roof. (Lee et al., 2015) The University of Texas at Arlington is situated in the center of a growing metroplex and as such the campus landscape should also serve as an example for the community and function as a leader in positive environmental trends. (Walton & Sweeny, 2014) Further, the information provided here, as well as the presence of a climate resilient landscape will function as an example of best practices for students.

There is currently no concise matrix to guide the design of socially active climate resilient landscapes; with their creation designers and university faculty can easily examine existing landscapes and determine whether they are

socially active healthy landscapes suited to be resilient to extreme weather events. They can also use the matrix to inform the design of future projects to meet these metrics.

As research has shown that access to and views of green space have a positive effect on mental and physical well-being, it follows that a resilient landscape will have a positive effect on the staff and student body by presenting them with a thriving landscape to look at and relax in. (Thompson, 2018) In addition to providing human benefits, climate resilient landscapes contribute to less flooding, reduced heat island effect and reduced maintenance costs. (Resilient Design, n.d.)

1.8. Research Delimitations

This thesis focused on data regarding United States public universities with the goal of creating guidelines tailored for North Texas Universities. While the design interventions presented herein focus on the unique environment of the UTA campus landscape, the climate specific research is applicable to landscapes throughout North Texas. With adjustments for regional differences the guidelines could be used on any campus.

1.9. Limitations

Limitations included the time limit of an academic calendar year, the number of respondents to the survey and the number of industry professionals who were available for an interview. Interviews provided insight but it should be noted that what works for one campus will not necessarily work at another university with a different political climate, set of values or budget allotment. The researcher's connection to, and enjoyment of the CAPPa Courtyard might present an unintended bias and should be considered a limitation.

2. Literature Review

2.1 Introduction

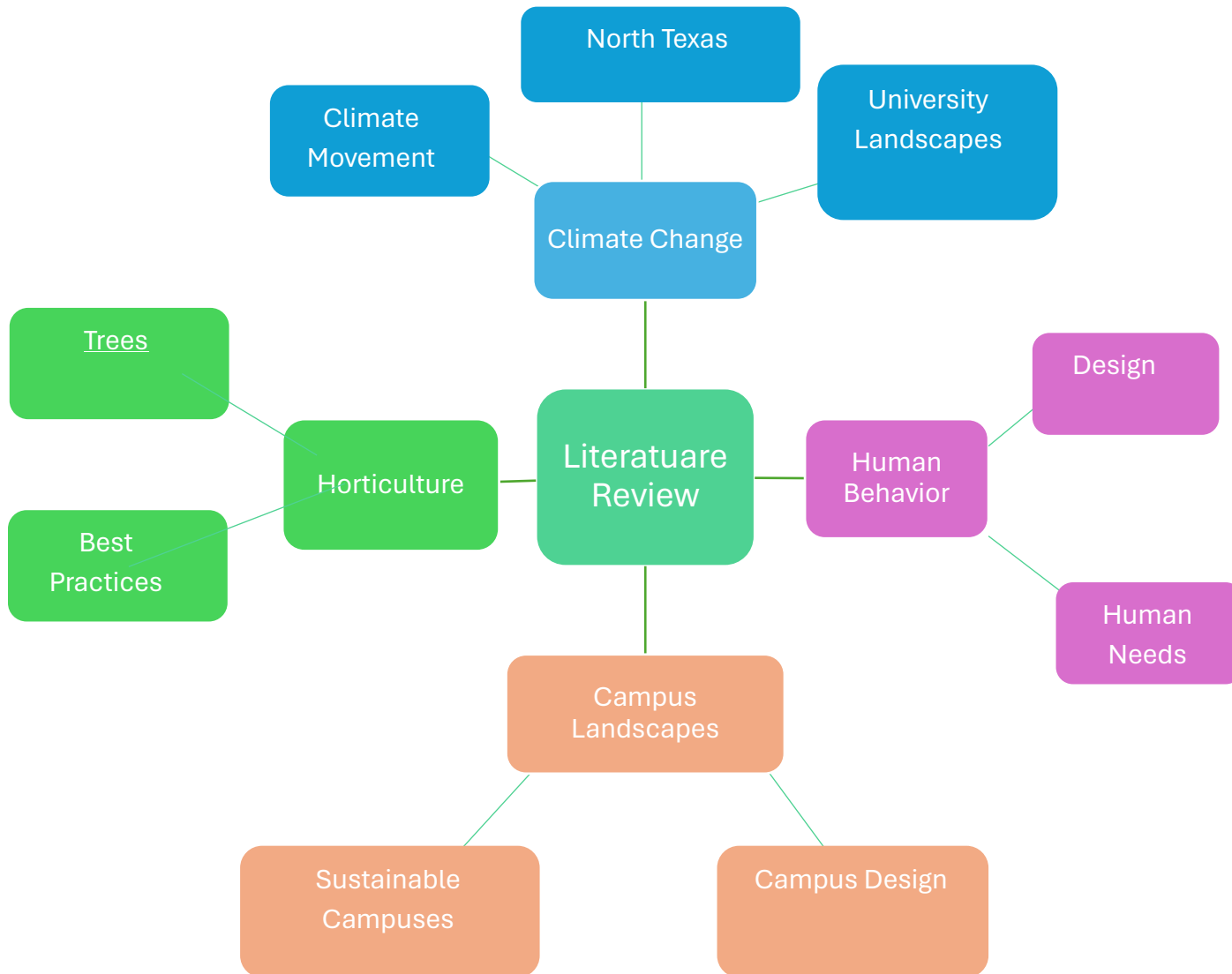


Figure 2-10 Literature Review Topics

The literature review, illustrated in figure 2-1, focused on climate change, human behavior, campus landscapes and horticultural guidelines. The climate change subchapter covers what effects will be felt in North Texas, the climate movement, climate resilience. Subchapter 2.4 examines human behavior, and what design principles lead to greater comfort and socialization. Subchapter 2.5, the subheading on campus landscapes looks at the desired functions of a university campus landscape, what has been published on the University of Texas at Arlington landscape and what are trends in sustainable campuses. Finally, horticultural best practices in the final literature review subchapter.

2.2. Climate Change

2.2.1. Climate Change in North Texas

According to the city of Dallas, extreme heat, drought, flooding, and public health are the risks from climate change in the area. (Johnson, 2020) To this list, the North Central Texas Council of Governments (NCTCOG) adds increased average annual temperature and poor air quality. (NCTCOG, 2020) Rising temperatures will result in decreased soil moisture which will in turn affect plant populations. (Nielsen-Gammon et al, 2021)

Landscapes in the Dallas Fort Worth Metroplex have suffered from a series of intense weather events over the past few years. A late season record cold in 2021, followed by a harsh drought in 2022, another freeze in the winter of 2022, and the record-breaking heat and drought of 2023 have had their toll on the landscape, leading to the death and decline of many non-native species. (Sperry, 2023)

2.2.2. Climate Movement

There is growing urgency to respond to Climate Change among a variety of public, private and governmental agencies. In 1992 the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change adopted the treaty: United Nations Framework Convention on Climate Change and in 1995 the Conference of the Parties (COP) met for the first time. (United Nations, n.d.) In 2021 two hundred medical journals from across the globe published an editorial calling Climate Change the “greatest threat to global public health”. (Choi-schagrin, 2021) The World Health Organization has also recognized it as a threat to public health.

In August of 2023, while speaking at the Sustainable Infrastructure Resilience and Climate Consortium at the U.S. Military Academy at West Point, the United States Department of Defense’s (DOD) Deputy Secretary of Defense Kathleen Hicks emphasized that climate change is a national security issue which requires the DOD’s attention. Climate change has been listed as a threat to US security since 2008. (Garamone, 2023) The United States, 33 American States and 58 cities, including Dallas, Texas, have since written their own Climate Action Plans. (U.S., 2023)

In 2021 ASLA signed the International Federation of Landscape Architects (IFLA) Climate Action Commitment which was signed at COP26. (ASLA, 2021) In 2022 ASLA achieved observer status and sent two landscape architects to represent the field at COP27. (Green, 2022) The following year, at COP28, the second year ASLA participated as a Non-Governmental Organization (NGO) observer, two ASLA delegates attended in person and eight attended virtually. Dr. Diane Jones Allen, UTA's director of Landscape Architecture, attended as an ASLA Climate Action Plan Task Force member as one of eight virtual delegates. There were also three landscape architecture professionals who attended in person. (Green, 2023)

In September of 2023, the University of Texas at Arlington held the "2024 Open City Conference: Resilient Futures", a new cross disciplinary initiative between the College of Planning Public Affairs and Architecture (CAPPA), the Army Corps of Engineers, and DFW ASLA. Nature-based solutions and resilience was the focus, with a goal of bringing different fields together to create solutions to the climate crisis. (UTA, 2023) The conference broke out into focus groups which discussed portions of ASLA's Climate Action Field Guide, which the American Association of Landscape Architects released along with their Climate Action Plan in 2022.

2.2.3. Campus Landscapes & Climate Change

Sustainability for university campuses is an issue of growing importance (Gomez & Derr, 2021) and more universities are transitioning towards sustainable, climate resilient landscape designs. There are multiple reasons for implementing a sustainable university campus landscape. A university landscape can serve as an example for the community as well as function as a leader in positive environmental trends. Sustainable campus landscapes can also be a location to test new practices, create a positive impression for alumni and possible donors, as well as a cost saving measure. (Walton & Sweeney, 2014) Private Universities such as Duke, the University of California, Berkeley, and Cornell, as well as Kansas State, Georgia Tech, and other public institutions have updated their landscapes better fitted to the regional climate. Over four hundred Universities have already signed a pledge with Second Nature, a nonprofit organization committed to promoting climate action at institutions of higher education, vowing to become carbon neutral. (Ajasa, 2023) Second Nature also oversees the University Climate Change Coalition (UC3) which connects the leading research universities across the world to influence and accelerate climate solutions in communities, campuses and globally. (UC3, n.d.)

2.3. Human Behavior

Despite centuries of evolution, the human need to feel safe and comfortable has not changed. People tend to feel most comfortable in situations with adequate prospects and refuge. (Appleton, 1975) Prospect, or the ability to visually survey one's surroundings, makes it easier to see if one is being approached or keep an eye on threats or opportunities. Refuge is a sense of safety and protection from hazards which could be weather, animals or otherwise. Through careful observation of small urban spaces William H. Whyte learned nine themes of human behavior in urban settings which are applicable to the outdoor spaces on the UTA campus. (Whyte, 1980) First, he noted that environments with a higher ratio of women to men tend to be used more often. Second, people like to be around other people; spaces with greater congestion draw greater crowds than less inhabited spaces. Third, seating in a variety of forms and heights; seating options should be comfortable, plentiful, arranged with socialization in mind and ideally there should be chairs to give users the choice to decide where to sit. Seating should be built into the space in ledges and walls with consideration for the intense heat by including many of those spaces in the shade. Fourth: sun, wind, trees, and water influenced a site's success. In the cool months users enjoy sitting in the sun and then it is desirable to have plenty of access to shade. Wind is important to provide cooling breezes. Trees should be placed at every twenty-five feet of sidewalk, and they should include spaces to sit and take advantage of their shade. Water in the form of pools can provide an attractive focal point or fountains can be used as a form of white noise. The fifth factor which resulted in a site's popularity is access to food. Relation to The Street is the sixth factor; successful plazas are either on a street corner or are adjacent to a busy thoroughfare. The Engineering Quad has this to its advantage; it is situated near one of UTA's largest pedestrian gateways and a vehicle drop off point. Seventh is absence of "undesirables" which can be related to safety which will be covered more thoroughly in the following subchapter. Eighth is capacity, or the concern that an area will become too popular and therefore too crowded. Whyte's research found that people tend to self-regulate, and if a space is too crowded, they will not spend time there. The final factor for successful socialization in urban spaces is triangulation. This is an external stimulus that creates a link between people prompting them to interact. (Whyte, 1980) An example of this could be when a student sees an owl on campus and points it out to a passerby.

2.3.1. Safety

Comfortable spaces for people have good prospect-refuge and is illustrated by Crime Prevention Through Environmental Design (CPTED). CPTED is a set of design principles which lead to a better feeling of safety and a reduction in crime. The term was developed by C. Ray Jeffreys with influence from Jan Jacobs. The principles involve natural surveillance, or the in or out of a space, territorial reinforcement, using hardscaping or other measures to communicate boundaries, natural access control which include physical barriers, and maintenance to indicate a space has a level of care and is not abandoned (Storck, 2019)

2.4. Campus Landscapes

University campuses offer spaces for students to learn, but they also serve the important function of existing as a space to stimulate curiosity and facilitate impromptu encounters with other students, faculty, and art as well as a space to socialize. (Dober, 2000) Much of the education which takes place on a campus occurs outside of formal areas, these areas also provide opportunities to participate in activities or engage with students or groups that might be outside of one's regular circle. (Marcus & Francis, 1998) Similar to a city many of the encounters and activities take place outside of the buildings. Outdoor campus spaces facilitate circulation, offer spaces to study, relax and enjoy the aesthetics of the location. The book, *People Places: Design Guidelines for Urban Open Space* offers several suggestions for spaces that a successful campus might contain. A home base next to a building where students participated in their daily activities; this serves a psychological need of having a "home away from home". To further define this space the authors of *People Places* recommend designating spaces around the building as a front porch, a front yard, and a backyard. Further, the design should differentiate between the "front door" - or main entrance - and "back door" - for trash removal or deliveries. (Marcus & Francis, 1998) The front porch should be well lit and a dominant feature at night. To provide a sense of transition from private to public it should be partially enclosed, this transition has a beneficial effect on stress levels. There should be comfortable seating and a space nearby to buy affordable food or drinks. The backyard should be more enclosed and more private than the front and it should be large enough to occasionally hold big events but not so large that it feels empty when only a few people occupy the space. (Marcus & Francis, 1998)

2.5. Climate Resilient Landscapes

The International Federation of Landscape Architects (IFLA) Climate Action Commitment states that climate resilience will “*enhance capacity, biodiversity, and resilience of livable cities and communities.*” Through green infrastructure methods landscape architects will reduce flooding, mitigate the urban heat island, and reduce risks of drought, flood, and fires. To achieve this goal ASLA will develop and share resources and tools to support landscape architect professionals and give them the tools they need to meet these challenges. (ASLA Climate Action Plan, 2022)

The ASLA Climate Action Plan has three elements: vision, goals, and initiatives. (Climate Action Plan Executive Summary, n.d.) The vision element states the goal of zero emissions and increased sequestration, economic benefits, address climate injustices and restore ecosystems by 2040. The goals are in three parts. First, Practice: Scale Up climate Positive Approaches, followed by Equity through empowered communities is, and finally Advocacy through building coalitions. The initiatives element further defines these by carbon drawdown and climate resilience. (ASLA, 2023) The Climate Action Plan Resilience Toolkit offers four objectives to meet their climate action goals. (1) Increase ecological services to improve climate resilience. (2) Protect and increase biodiversity. (3) Incorporate management practices that are ecologically sound. (4) Improve food security through regenerative local agriculture.

Despite the growing emphasis on climate resilience there few examples of universities which acknowledge the importance of resilience as it relates to the landscape. California State Polytechnic University Humboldt is leading the way with the Climate Resilient Landscaping Demonstration Project which was partially funded with a grant from Second Nature. (Laying the Groundwork, 2022) The demonstration project utilizes native plants which can recover under future climate constraints. These will have the added benefit of saving money, reducing maintenance, using less water and benefiting local flora. The project will serve as a living laboratory for environmental science and management majors and environmental education and interpretation students who will produce informative signage and educational content.

The University of Illinois Urbana-Champaign recognized the importance of the campus landscape as a place to sustain human health and well-being as well as its valuable role in sequestering carbon, purifying the air, and

beautifying the university. Noting the importance of the landscape they acknowledged the need to create a future focused landscape plan which would be resilient to the challenges yet to come. (iCAP, 2019) In order to be better prepared for the future the University of Illinois drafted a Resilient Landscape Strategy which outlined existing challenges and what their goals should be. They admit to the common mistake of acting as though the spaces between buildings are of little consequence. Five key challenges to campus landscapes were identified. (1) While there is a Campus Master Plan there was no landscape master plan to provide a united vision nor are there adequate guidelines to secure its future success. (2) There is no clear structure for the decision-making process. To counter this, they propose a Campus Landscape Department to clarify the roles of the landscape architect and a landscape design appeal process to ensure future projects align with the landscape plan and overall vision. (3) Out of date and inadequate rainwater management. (4) Inconsistent resources to fund continued landscape improvements and (5) the grounds department does not have adequate resources. (UIUC, 2019)

2.6. Case Study Location

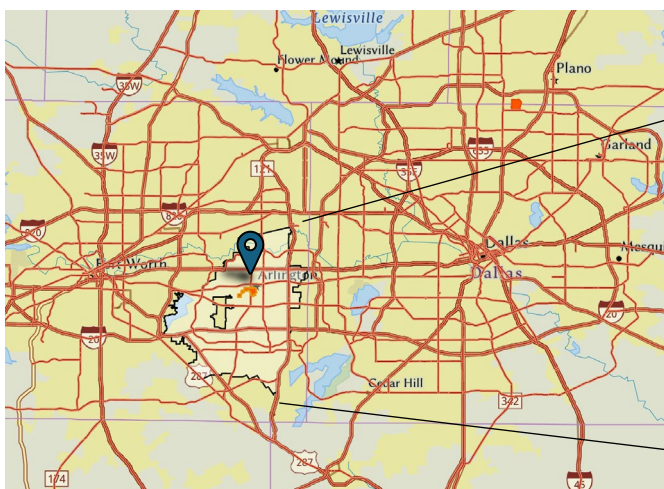


Figure 2-2 UTA Relation to the DFW Metroplex
Blue Icon: UTA

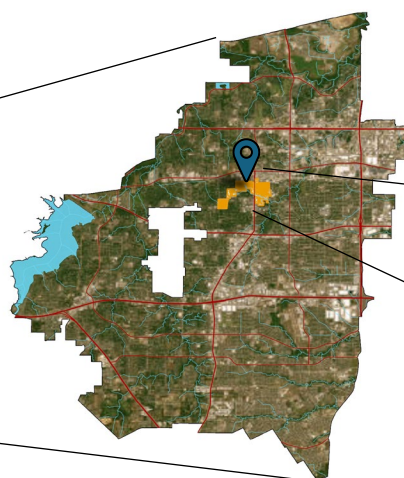


Figure 2-3 Location of UTA Within Arlington

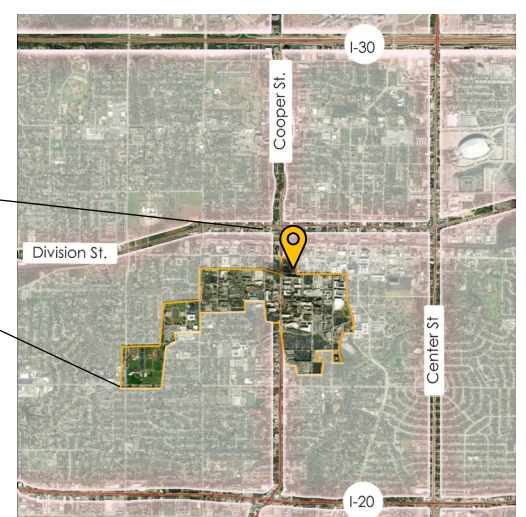


Figure 2-4 UTA Relation to Major Roads
Orange Icon: Engineering Quad

The University of Texas at Arlington (UTA) is a public university situated four blocks south of downtown Arlington. Arlington is situated between Fort Worth and Dallas and is in the middle of a rapidly growing metropolitan area. (Rubin, 2024) In 2021 Arlington had a population of 392,304 (Arlington, 2024) and it is expected to continue growing. As a research university located between interstate 30 and 20, UTA is poised to influence a large population. This includes people who travel here for conferences and other events. Because universities function as and can be used as scaled down versions of cities (Guerrieri et al., 2019), and due to its central location in DFW as a research university, the UTA campus is an excellent location to trial and display the new design responses to climate change.

Over the course of its history the University of Texas at Arlington has undergone many changes, had many masterplans, and various design solutions have been proposed and implemented by the landscape architecture faculty and students. The 2007 UTA Master Plan Guide for 2005 - 2020 included goals related to the campus landscape. The guide stated a desire for more “greening”, tree lined pedestrian malls, shaded gardens, outdoor rooms, and a traditional landscape which would enhance the university's reputation. (UTA Campus Master Plan Update, 2007) Landscape architecture staff and students, with occasional collaboration with architecture or sustainable urban design students, have worked to design and maintain several areas of the campus as illustrated in the following examples. The first faculty led design was the Campus Administration Building Courtyard in 2006. (David Hopman, personal communication, December 11, 2023) In 2008 the UTA Green Roof was installed on the Life Sciences Building as a collaboration between student groups, UTA facilities management, Professor Hopman, and landscape architecture graduate students. (Bushe, 2012) In 2012 The Green at College Park, which was designed by local multidisciplinary firm Schrickel Rollins (now Parkhill) with input from Professor Hopman, was one of the first Sustainable Sites Initiative Certified landscapes. (Meinhold, 2012) In 2015 native plant polycultures were installed in front of the CAPP building by students in Professor Hopman’s Plant Design and Ecology and the Academic Success Skills in Architecture/Interior Design class. (Pina, 2015) The polyculture grew to include two nearby raised planters in the spring of 2022. In the same year the Landscape Architecture Planting Design course led by Professor David Hopman and with input from the Native American Student Association redesigned the newly dedicated Land Acknowledgement Courtyard outside of the Roundhouse Planetarium Building. (Goodrich, 2022) In 2023 Landscape Architecture professor Taner Özdil and his students published the US EPA RainWorks Green Infrastructure report which outlines some design challenges and goals for the university. (Özdil et al., 2023)

Throughout the 2023 – 2024 academic year the multidisciplinary design firm Smith Group hosted focus groups, distributed surveys and hosted meetings for the creation of a new master plan. The guiding principles were to create a sense of place, align with the University’s mission, research space, and infrastructure for a resilient future. (Masterplan Kickoff, 2023) At the same time UTA published its strategic plan with the four pillars: People and Culture, Alumni & Community Engagement, Research & Innovation, and Student Success. (UTA, n.d.) Through their research SmithGroup identified several overall themes of areas in need of improvement and ten of those could be addressed through enhancements to the campus landscape. These emerging themes were strengthen campus identity, improve first impressions, increase research space, focus on key buildings, improve porosity, improve

appearance, increase the number of outdoor spaces, create a signature open space, improve and clarify mobility, and expand outdoor recreation. (UTA Campus Masterplan, 2024)

The 2016 landscape architecture thesis, *Assessing User’s Perceptions of Campus Landscapes: Learning from The University of Texas at Arlington* found that out of 342 users, 40% of respondents rated the Engineering Quad as one of their least favorite areas on campus citing its unused open space, few trees and lack of a focal point. (Romao, 2016) Despite the surveys gathered, and the thesis written after installing the REACH sculpture on the Quad, users still felt there was no notable focal point. Passive observations by Gloria Romao for her thesis supported the finding that there was no shade or focal point. This, along with a current evaluation of the campus, cemented the decision to focus this thesis on this portion of the campus.

2.7. Horticulture

Function	Environment	Aesthetics
Climate Control	Soil characteristics	Color
Visual Control	Light Level	Texture
Physical Control	Water Quality	Form
Erosion & Water Control	USDA Hardiness Zone	Size
Noise Control	Temperature Range	
Odor Control	Wind Tolerance	
	Pests & Pathogens	
	Air Pollution	
	Maintenance & Culture	
	Practices	

Table 2-5 Function, Aesthetic, & Environmental Considerations (IFAS, n.d.)

One of the fundamental principles in landscape design and management can be condensed into four words: Right Plant, Right Place. (Denny & Hansen, 2019) This refers to choosing appropriate plants for the location where they will be planted. This goes beyond “choose a salvia” to choosing the correct species, variety, provenance, or

genotype for the site. In order to do this properly one must know the characteristics of the plants and site conditions. For optimal performance one must consider: what are the desired functions and aesthetics of a design and what are the environmental conditions of the site (table 2-1). (Denny & Hansen, n.d.)

Another important guideline to follow for a successful landscape is the 10 -20-30 rule. The rule, which was first published in 1990 in a paper titled "*Trees for Urban Planting: Diversity, Uniformity, and Common Sense*" dictates that one should plant no more than 10% of any one species, 20% of a single genus and 30% from one family. (Sabatini, 2024) This is normally applied to trees, but it is a good general rule to follow for all landscape plants. There are plenty of examples of why one should avoid using all of the same species or genus in the landscape. In the early 1900's Dutch elm trees were planted throughout eastern portion of North America and a typical street was shaded by the trees' arching branches. When a disease made its way across Europe and then America in the 1930's it easily spread from tree to tree and decimated the urban forest which had relied heavily on the single species. (Alfred, 2009) A similar phenomenon occurred in Texas with rose rosette disease. Roses, particularly the "knock-out" variety, were planted in masses throughout DFW. Because plants were planted in such large monocultures the disease, which was spread by a mite carrying the rose rosette virus, could easily spread to all the plants in the vicinity. (Lunday, 2024) Gardeners hoped that some species of roses would be resistant, but as of yet this has not been shown to be the case. Best management practices now suggest spacing them out, intermixing them with other genera or not using them at all. (Sperry, 2022) Another example illustrating the need for the 10-20-30 rule can be seen with Oak wilt disease. Best management landscape practices should be followed to avoid the spread of the disease, but as all red oak species are susceptible it is advisable to plant a variety of species. (Texas A&M, n.d.) As white oak trees are only resistant but not completely safe against the disease the "common sense rule" requires that several genera should be used in a landscape. In north Texas this could be achieved by using red oaks, burr oaks, cedar elms and bald cypress in a single landscape. In addition to the benefit of greater resilience, a mixture of plants as in a polyculture provide more ecological and aesthetic value than a monoculture alone.

3. Research Methods

3.1 Methodology

The research was conducted through the following steps: a literature review, followed by precedent studies, interviews with industry professionals, a case study and site selection, and analysis of findings. In addition, UTA Master Plan and Climate Action Plan meetings as well as DFW ASLA climate change meetings were attended. All together this research led to the creation of a Socially Active Climate Resilient Landscape Matrix (SACR Landscape Matrix) to assess and guide the design of socially active climate resilience at universities and a site-specific design.

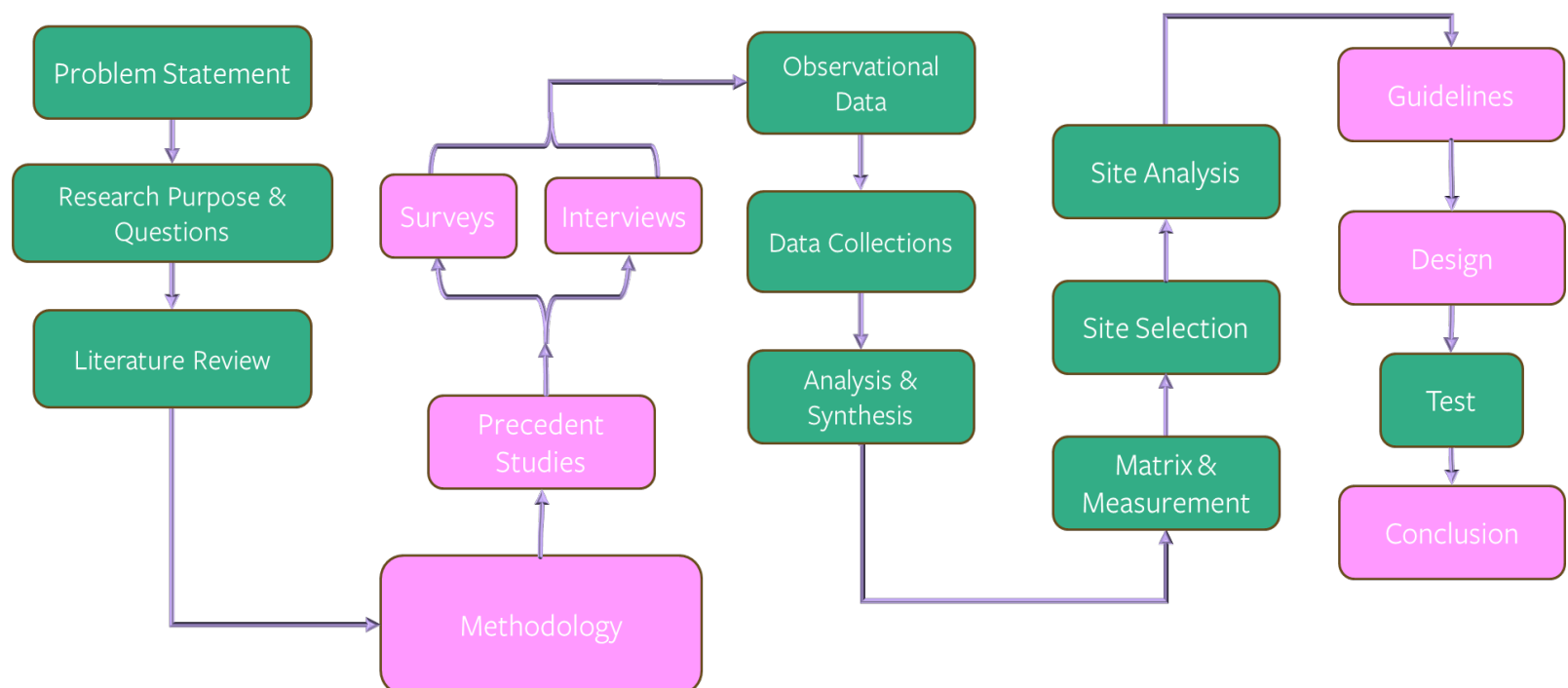


Figure 3-1 Methodology Flowchart

The process which guided this thesis is illustrated in figure 3-1. The research fed back into the purpose which evolved to the ultimate decision to create a set of guidelines which would foster socialization while being suited to withstand factors of climate change. The literature review covered topics related to climate change, human behavior, resilient landscapes and how campus spaces fit into each of those This included the growing recognition of the need to act on climate change on a larger scale but also by universities on their campuses. From fall of 2023 through spring of 2024 there have been many climate and campus planning meetings. On UTA there have been multiple Master Plan meetings, two Energy Transition and Resilience Plans, and a Conference on Climate Action. In addition to these the TX ASLA conference was held in late April and DFW ASLA held monthly virtual Climate Action

Plan meetings. The researcher attended the majority of these to gain insight into the objectives and opinions of the future for UTA and DFW.

3.2. Precedent Studies

Precedent studies provided insight on climate change design solutions implemented in the United States. Two certifications and six associations were used to choose study sites and influence the design Socially Active Climate Resilient Landscape Matrix guidelines. These were: the Landscape Architecture Foundation, ASLA Awards, the Association for the Advancement of Sustainability in Higher Education, Tree Campus Higher Education, the Professional Grounds Management Society, Second Nature signatures or assessments, SITES Certifications, and the Society for College and University Planning (SCUP). Second Nature and the Association for the Advancement of Sustainability in Higher Education (AASHE) provide guidelines, benchmarks, and resources for universities. Tree Campus Higher Education was founded by the Arbor Day Foundation in 2008 to help colleges establish and maintain their urban forest. (Arbor, n.d.) The Professional Grounds Management Society (PGMS) is a member organization of predominately institutional grounds managers who oversee a variety of facilities, parks, universities, and cemeteries as well as individuals and organizations involved in the green industry. (PGMS, n.d.)

University	UT Dallas	Georgia Tech	Arizona State	UT Arlington
LAF	Great Campus	No	Case Study	No
ASLA Award	No	Yes	Yes	No
AASHE	Gold	Silver	Platinum	Silver
Tree Campus	Yes	Yes	Yes	No
PGMS	No	Award	No	No
Second Nature	No	Commitment	2016	No
SITES	No	No	Orange Mall	Green at College Park
SCUP	2017	2023	2018	-

Table 3-2 Precedent Site Affiliations & Accolades

Three universities were chosen as locations for precedent studies: The University of Texas at Dallas, Georgia Institute of Technology, and Arizona State University. These universities had awards or certifications from at least

four industry related organizations (see figure 3-1). The University of Texas at Dallas, which the LAF listed as a Great Campus, was chosen primarily for its location in relation to UTA. Arizona State University, which has a SITES certified landscape, and Georgia Tech, which won the PGMS Green Star award for Urban University Grounds, both had six awards and or certifications. Like UTA, the precedent study universities are public institutions and are in the southern half of the United States. Although the site conditions are not replicas of those in Arlington, they face challenges similar to those at UTA such as extreme heat, intense precipitation events, and drought and developed differing design responses.

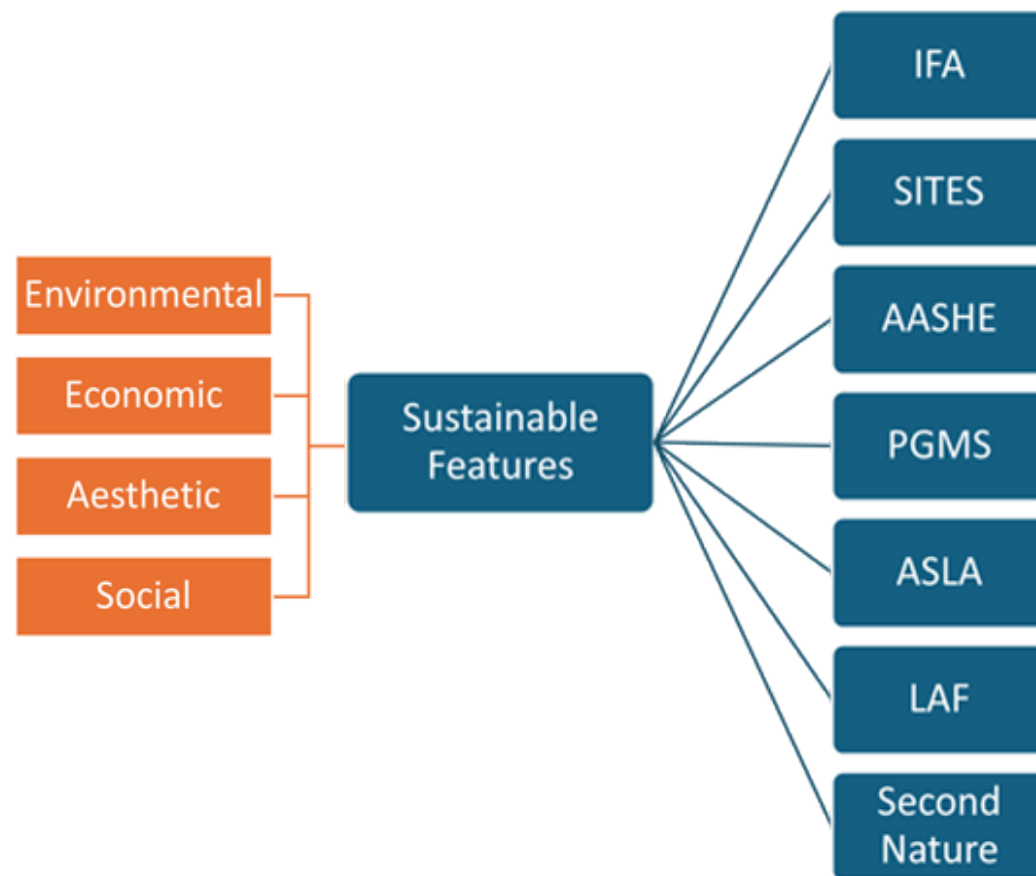


Table 3-3 Sustainable Features

Sustainability is frequently described as having three pillars: social, environmental, and economic. (EPA, n.d.) Design disciplines list aesthetics in their list of priorities (Hopman, 2016). Because the goal of this research is to enhance socialization, and as philosopher John Dewey stated, aesthetic experiences can “enhance and intensify everyday experiences” (Leddy & Puolakka, 2021), the design solutions presented here consider four pillars of sustainability, adding aesthetic. The seven associations listed above were used to guide what metrics should be used to identify sustainable, climate resilient features in the precedent sites. Table 3-2 above illustrates this point.

3.3. Interviews

A landscaped university space involves landscape architects, groundcrews, horticulturists or nursery growers and university staff. Therefore, interview subjects were sought from a variety of industry related backgrounds. This included participants who had one or more of the following certifications or affiliations: International Society of Arboriculture (ISA) certified arborist, certified nursery professional, Landscape Architect, Texas A&M AgriLife extension agent, and Professional Grounds Maintenance Society (PGMS) member. Interview questions were geared towards the individual's area of expertise.

The Institutional Review Boards (IRB) reviewed questions, a request to be interviewed and consent forms to ensure the safety of participants. The request to be interviewed and consent forms were emailed to interview participants and returned electronically signed. One interview was conducted virtually and three were in person. The interviews were conducted with the purpose of identifying best practices or impediments to designed spaces, especially those that occur on university campuses. Interview subjects were given the option to remain anonymous but gave their consent to be quoted.

The three interview participants were Laura Miller, Erik Trevino and Jason Gregory. The first two interviews were conducted in person at the participants office, while the third was virtual. Laura Miller is one of the Tarrant County's A&M AgriLife Extension Agents as well as an ISA Certified Arborist and Texas Certified Nursery Professional. Laura has over twenty-two years of horticultural experience as well as degrees in Horticulture and Agricultural Education. Erik Trevino is the Director of Landscape and Grounds at the Texas Christian University (TCU). TCU is known for its well managed landscape and was awarded a national "Grand Award" by the Professional Grounds Management Society in 2023 and has been recognized as a Tree Campus Higher Education Institution eight years in a row. (Lamers, 2023) Erik is an ISA Certified Arborist and the PGMS 2024 Texas Branch Vice President. Erik has over ten years of experience in landscape maintenance, some of that time included overseeing the maintenance of the Laura W. Bush Native Texas Park at the George W. Bush Presidential Center. Jason Gregory is the Institute Landscape Architect at Georgia Tech. He is a registered landscape architect with over twenty-five years of experience in landscape planning and design with twelve of those at Georgia Tech.

3.4. Socially Active Climate Resilient Landscape Matrix

Rating System	
Category	Score
Poor/None	0
Partial/Adequate	1
Existing/Good	2
	<i>*Too Early</i>

Figure 3-4 Socially Active Climate Resilient Landscape Matrix Rating System

The research led to the determination that the best way to answer the questions “How can campus landscape design positively address the design principles for both social interaction and climate resilience?” and “What are the design principles for socially active outdoor spaces that are best suited for a college campus?” would be to create a matrix which could be used by design and maintenance professionals as well as laypeople to analyze existing spaces and to guide the design of future landscapes. The matrix has two parts; the first synthesizes data on general human behavior design guidelines and the services a university campus provides to its users. The second portion focused on the climate resilient aspect. This is built on the premise that as healthy site

appropriate plants are more likely to live longer than a plant susceptible to disease or in growing conditions contrary to where it evolved, then they are also more climate resilient and better able to perform their ecological and design functions. As trees are the go-to solution to combat the Urban Heat Island Effect (EPA, n.d.), one section of the Matrix is devoted to promoting and identifying tree health. A tree that is declining, improperly pruned or missing branches cannot provide much shade. The next portion covers general landscape guidelines and specific climate resilient measures. To use the Matrix, each metric was given a score of 0-2. For proposed designs, metrics which cannot be assessed until after their installation, the input would be **Too Early*. The rating system is shown in figure 3-4.

3.5. Survey

Surveys were disseminated online on LinkedIn, Instagram, email or shared via a QR code. The questions were thoroughly reviewed by the IRB and were completely anonymous unless participants chose to leave identifying information. Survey participants were UTA campus users over the age of 18. This included staff, faculty, visitors, students, alumni, and students, both undergrads and graduates. As of 2022 the population of UTA includes over 1,500 faculty and 2,500 plus staff members and roughly 41,000 students. Students are 32% Hispanic or Latino, 22% White, 13% African American and 12% Asian. Fifteen percent of the population are international students. (Texas

Monthly, 2024) The purpose of the survey was to learn where users congregated, what features they liked, which spaces they preferred and if they encountered spontaneous interactions with other students or faculty.

3.6. Observation

Passive observations were conducted to create ethnogram charts, which provided a better indication of how the sites were used than using published data or word of mouth alone. (Zeisel, 2006) Over the course of three months the researcher noted activities and frequency of use at three different sites on the UTA campus. This data was collected and analyzed to inform which site could benefit most from a redesign as well as to observe what activities UTA users participated in, where they sat and what seating options were most popular.

3.7. Conclusion

To answer the question: “how can campus landscape design positively address the design principles for both social interaction and climate resilience?” data was gathered on climate resilience, campus landscapes, and socially active community spaces. The ASLA Climate Action Goals and horticultural best practices influenced the environmental health and resilience portion of the matrix. Literature on campus landscape design and human behavior guided the first portion of the matrix.

Figure 3-4 illustrates the guidelines and information which informed the creation of the matrix. The data gathered from expert interviews, precedent studies, literature review and surveys resulted in the Socially Active Climate Resilient Landscape Matrix, which can be found in full in Appendix D.

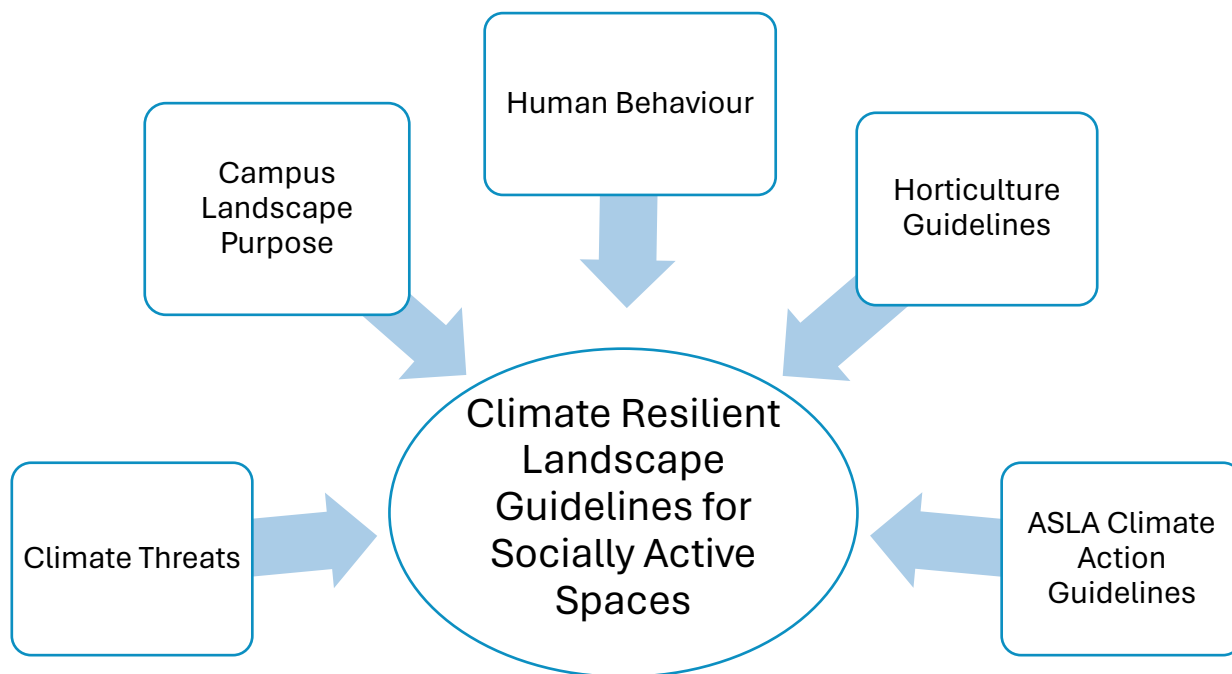


Figure 3-5 Socially Active Climate Resilient Matrix Inspiration

4. Site Selection

4.1. Site Selection Methodology

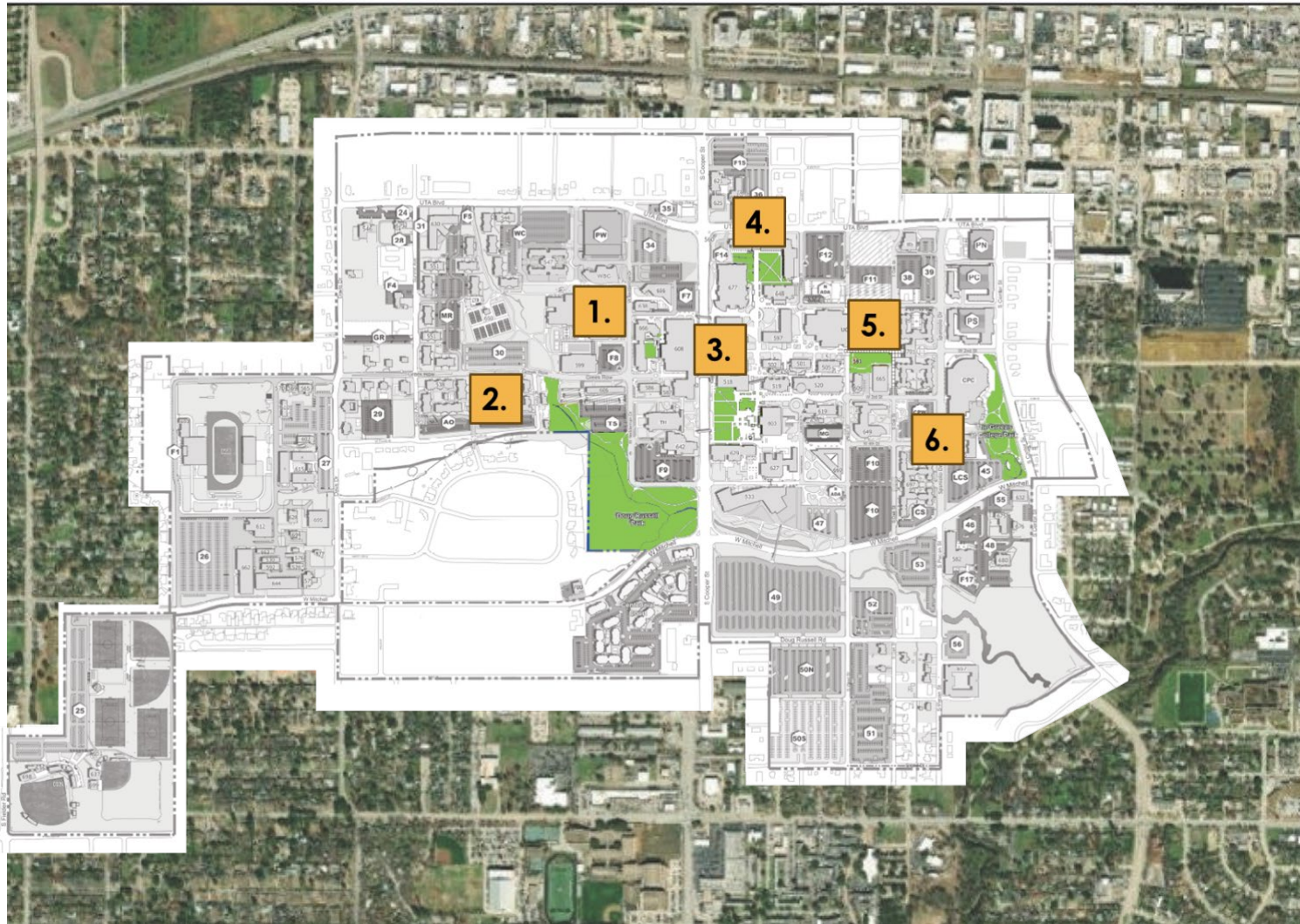


Figure 4-1 Notable Open Green Spaces on UTA Campus

The University of Texas at Arlington campus is in north Arlington and is bisected by Cooper St, a six-lane state highway. The campus is four hundred and twenty acres with roughly 21% tree canopy cover. (Özdil et al., 2023) There are six main open green spaces on the University of Texas at Arlington campus (figure 4-1); 1) the CAPPa Courtyard, 2) Doug Russell Park, 3.) the Library Plaza, 4.) the Greene Research Quad, 5) Brazos Park, and 6.) the Green at College Park. (Masterplan, 2024)

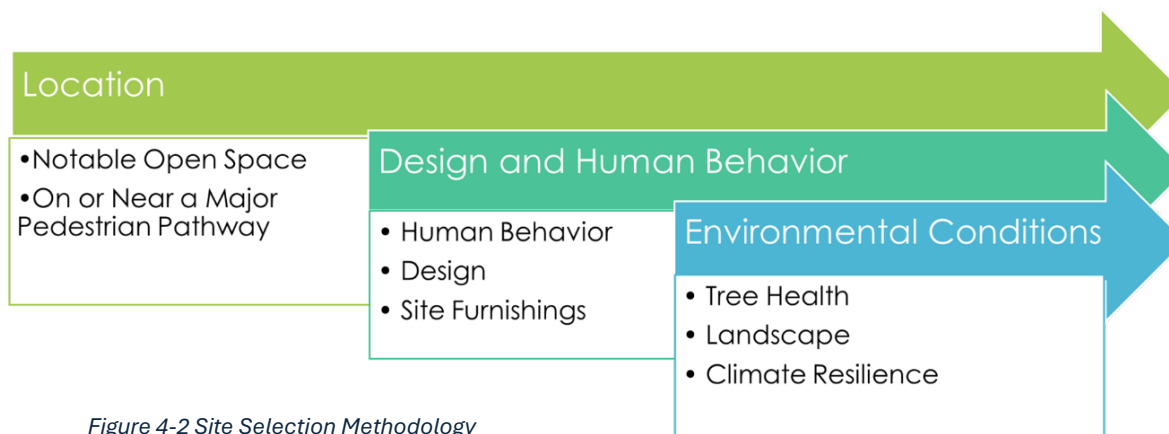


Figure 4-2 Site Selection Methodology

The process used to pick a space to redesign is illustrated in figure 4-2. First, to have the biggest impact on the most people the space should be located near a major pedestrian pathway and be a notable open space. Neither Doug Russell Park nor the Green at College Park fit these criteria as they are at the periphery of campus and there are no academic buildings next to them. It was then determined that due to its smaller size, popularity as an event space and recent investments in its landscape, Brazos Park was removed from the list of possible spaces. Based on these criteria the Greene Research Quad, CAPPA Courtyard and the Library Plaza were chosen to be the best spaces to choose from. Next, passive observations were conducted on each of the sites over a period of three months at various times and days of the week. Ethnograms were then created based on site observations to show where users gathered and what they did. Finally, the Socially Active Climate Resilient Landscape Matrix was used as a metric to analyze the three sites. The results can be seen at the end of this chapter in figures four-ten through thirteen.

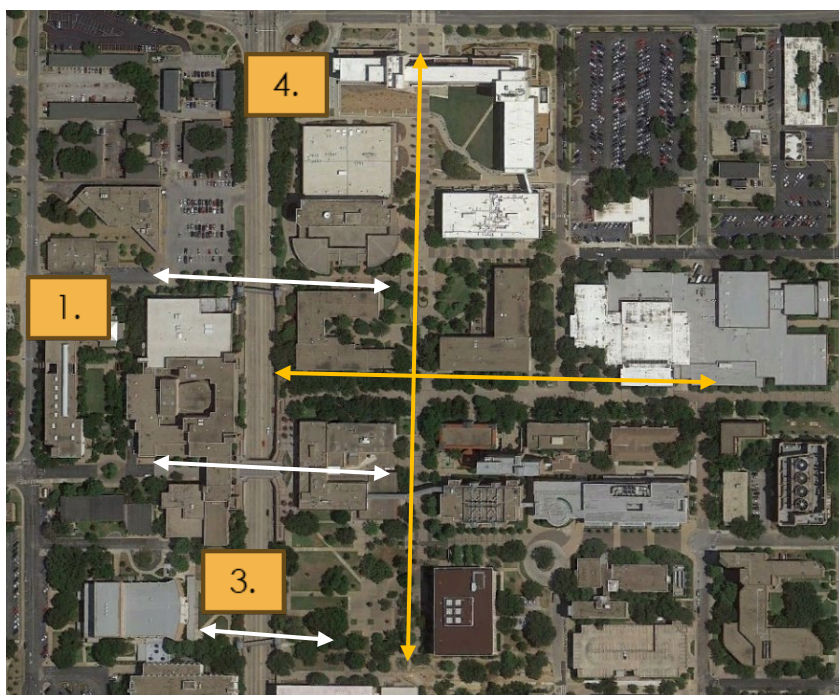


Figure 4-3 CAPPA Courtyard (1), Library Plaza (3) & Greene Research Quad (4)

Boxes one, three and four in figure 4-3 indicate the locations of the sites that were observed. The white horizontal arrows show the location of the three pedestrian bridges connecting the west and east half of the campus. The orange arrows run the length of the two pedestrian malls. Maps provided in 2023 by at the Masterplan presentations indicate that the walkway which passes through the engineering building is a pedestrian gateway with two vehicular gateways nearby at the intersection of UTA Blvd and Cooper St, and

College St. and UTA Blvd. There is a pedestrian drop off point at the corner of College and 1st St. The pedestrian mall

which runs from UTA Blvd to the SEIR building is the longest inner campus pedestrian walkway at a length of 504.57 feet.

4.2. Observation

These observations noted genders, general age, ethnic diversity, what and where activities took place. Without directly asking age and ethnicity could not be determined for certain and therefore results might not be accurate. Likewise, without video footage an exact count could not be made as users were often moving through several spaces at once. Due to these reasons, a general impression rather than an exact count was made.



Figure 4-4 Library Plaza

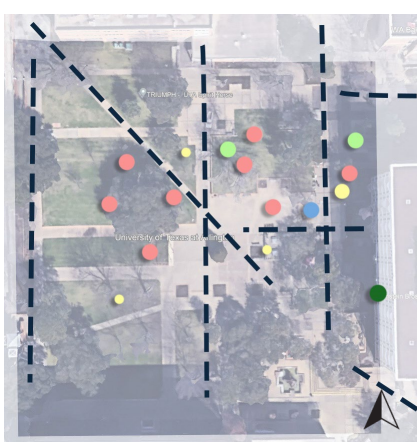
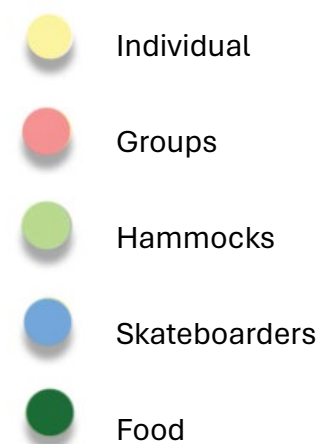


Figure 4-5 Library Plaza Ethnogram



Multiple visits to each of the locations yielded the results which are illustrated in figures 4-5, 4-7 and 4-9. The Library Plaza (figure 4-4) is an active space with a feel like that of a city square. Students were engaged in a wide range of activities from studying, resting in impromptu hammocks, skateboarding and tennis over a temporary net. The hammocks, and skateboarders are shown in light green and blue in figure 4-5. There are a variety of seating options with and without tables – many of which had electric outlets on them. Students of diverse ethnicities and genders could be seen seated throughout the space. The only time there was an apparent lack of diversity was when one of the student organizations had a booth set up, at which point those at the booth belonged to that group. This spot provided several opportunities for spontaneous social interaction as one of would be approached to sign a petition or buy something for a fundraiser.

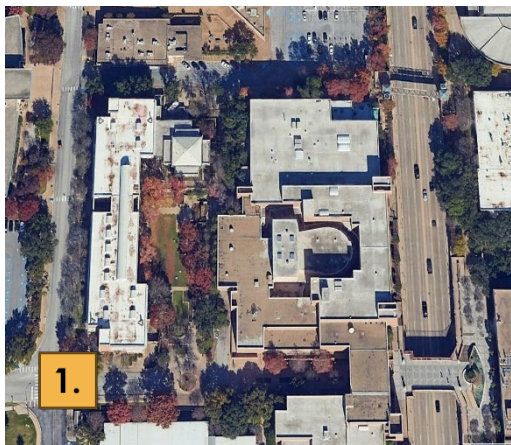


Figure 4-6 CAPP Courtyard



Figure 4-7 CAPP Courtyard Ethnogram

The CAPP courtyard (figure 4-6), which includes a second-floor terrace, had an intimate community and at times active feel to it. Students were seen to use all the walkways, to pace in the grass while assumably preparing for a class, play frisbee or soccer, study, socialize and relax on the provided chairs, benches, or seat walls. Over several visits the chairs and even the benches and tables were rearranged to suit the users' needs. A campus tour passed through on one occasion. Several people stopped to take a picture of the fountain either on its own, with their graduation regalia or a quick selfie. Unfortunately, the fountain itself is not wheelchair accessible and shifts in the pavement sections could present trip hazards. An individual practiced with their skateboard on the second floor terrace (see figure 4-7).



Figure 4-8 Greene Engineering Quad one year after Construction.

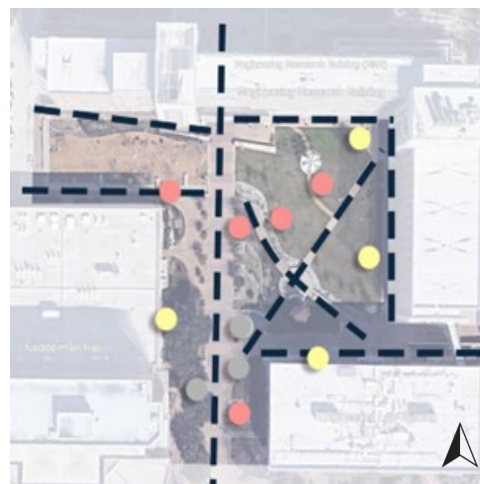


Figure 4-9 Greene Research Quad Ethnogram

The Greene Engineering Quad felt too open and unsheltered, there was little feel of refuge. The only spaces partially enclosed were those along the ERB and the covered walkway leading out of UTA, neither of these spaces had seating of any kind. The pedestrian mall was active with pedestrians, cyclists, scooters, and several maintenance vehicles. The four tables along the main walkway had no electric outlets but they were frequently in use. The tables and benches were fixed and could not be moved. They were used by individuals, groups of three to

four and at one time a student sat at them to fix his bike. There are Adirondack chairs on the main lawn which site users move to suit their needs. Unlike the CAPPa Courtyard and the Library Plaza there is nowhere close to the Engineering Quad to purchase food or drinks, aside from vending machines.

The observations of the CAPPa Courtyard and Library Plaza led to the conclusion that they are both socially active spaces which foster community and engagement. The spaces never felt empty or crowded. The amount of activity and number of users at the Engineering Quad were not in proportion to its size and location at a major campus gateway. The Quad, because it was practically one large open space with little aside from sidewalks and smaller trees to divide them, felt empty. All of the sites succeeded in attracting a diverse demographic. They had a mix of students and staff, genders, and ethnicities. There was no one gender or ethnicity in the hammocks, skateboarding or sitting in the provided benches and chairs.

4.3. Matrix Results

Aside from the site based ethnogram, the Socially Active Climate Resilient Landscape Matrix was used to inform the choice for which site to redesign. Results from site observations were tallied and, in every metric, the CAPPa Courtyard and Library Plaza scored better than the Greene Research Quad. The matrix and the scores can be seen in figures 4-11 to 4-13. Based on its score, location at a primary entrance, and the potential that it offers to create a space that UTA staff, students, the Greene Quad was determined to be the best space to redesign.

CITATION	METRIC	SCORE		
		CAPPA	Library Plaza	Engineering Quad
DESIGN & HUMAN BEHAVIOR				
	Design			
(Marcus & Francis, 1998)	Spaces at Building Entrances to Study & Socialize	2	2	1
(Marcus & Francis, 1998)	Shade plants, Structures, or other methods to cool users	1	2	1
(Marcus & Francis, 1998)	ADA Accessible	1	1	1
(Marcus & Francis, 1998)	The Space is Well Lit at Night	2	1	2
(Marcus & Francis, 1998)	Adequate Wayfinding	1	1	1
(Marcus & Francis, 1998)	Walkways Accommodate Pedestrians & Other Modes of transportation	0	1	1
(Marcus & Francis, 1998)	Space is Large enough for events but Does not seem empty Otherwise	2	2	1
(Marcus & Francis, 1998)	Eye catching feature or Focal Point	2	1	1
(Marcus & Francis, 1998)	Multiple events Can Occur at once such as studying, recreation and socializing	2	2	2
(Marcus & Francis, 1998)	Seating Options Away From Main Path	2	2	1
****	CPTED Safety: Visibility	2	2	0
(Marcus & Francis, 1998)	Walkways follow the natural desire to Take the quickest route	2	2	2
(Marcus & Francis, 1998)	Indoor Spaces Coordinated with the Outside Landscape to Provide a Visually Pleasing Connection	2	1	1
(Marcus & Francis, 1998)	Informative Educational Signs	0	0	0
(Marcus & Francis, 1998)	Plan for postoccupancy evaluation	0	0	0
(Marcus & Francis, 1998)	Can the budget maintain this space?	1	1	0
	TOTAL	22	21	15

Figure 4-10 Socially Active Climate Resilient Landscape Matrix: Design

CITATION	METRIC	SCORE		
		CAPPA	Library Plaza	Engineering Quad
DESIGN & HUMAN BEHAVIOR				
	Human Behaviour			
(Zeisel, 2006)	Frequently Occupied	2	2	1
(Zeisel, 2006)	Diverse Activities	2	2	1
(Zeisel, 2006)	Demographic Diversity	2	2	2
(Zeisel, 2006)	No User Conflicts	2	2	1
	TOTAL	8	8	5
	Site Furnishings			
(Marcus & Francis, 1998)	Bicycle Racks	2	2	2
(Marcus & Francis, 1998)	Adequate Safety Call Boxes	1	1	1
(Marcus & Francis, 1998)	Tables for eating & studying	2	2	1
(Marcus & Francis, 1998)	Seating options for individuals, or groups of various sizes	2	2	1
(Marcus & Francis, 1998)	Enough waste receptacles	1	1	1
(Marcus & Francis, 1998)	Seating Variety to Allow for a Diverse Activities in Varying Group Sizes	2	2	1
	TOTAL	10	10	7
	DESIGN & HUMAN BEHAVIOR TOTAL	40	39	27

Figure 4 -11 Socially Active Climate Resilient Landscape Matrix: Human Behavior & Site Furnishings

CITATION	METRIC	SCORE		
		CAPPA	Library Plaza	Engineering Quad
ENVIRONMENTAL CONDITIONS				
	Tree Health			
(MacDonagh, 2020)	Presence of Trunk Flare	1	1	1
(MacDonagh, 2020)	Round or Oval Tree Canopy	0	2	0
(MacDonagh, 2020)	Dense Tree Canopy	0	1	0
(MacDonagh, 2020)	Mulch in an Even Layer - Not Around Base of Tree	0	0	0
(MacDonagh, 2020)	Surface Roots that Radiate Outwards	0	1	0
(MacDonagh, 2020)	Healthy Branches: None Broken, Missing Bark Nor Any Fungus	0	1	0
(MacDonagh, 2020)	Roots: No fungus, cavities, compaction	1	1	0
(MacDonagh, 2020)	Trunk: No Cracks, wounds, fungus, missing bark	0	1	0
(MacDonagh, 2020)	No Codominant Branches	0	1	0
	TOTAL	2	9	1
	Landscape			
	No Invasive species: Vitex agnus-castus, Ligustrum lucidum, Ligustrum sinense, Nandina domestica, Photinia x fraseri	0	0	0
	Seasonal Interest	1	1	1
(PGMS, nd)	Plant Materials Are Thriving, & Require Little Maintenance	1	1	0
(PGMS, nd)	Planting Areas Are Properly Mulched	0	0	0
(PGMS, nd)	Biodiverse Plant Palette	1	1	0
	TOTAL	3	3	1

Figure 4-12 Socially Active Climate Resilient Landscape Matrix: Trees and Landscape Conditions

CITATION	METRIC	SCORE		
		CAPPA	Library Plaza	Engineering Quad
ENVIRONMENTAL CONDITIONS				
	Climate Resilience			
(Lunday, 2022)	Drought Tolerant Plants	1	1	1
	Freeze Tolerant of Local Conditions	1	1	0
(Lunday, 2022)	Heat Tolerant of Local Conditions	1	1	2
	No Known Disease or Pest Alerts *if pathogens exist, plant species should be used sparingly	1	0	0
(Lunday, 2022)	Prioritize Native Plant Specites	0	0	0
	Right Plant Right Place: Are the plants in the correct growing conditions such as sun, shade or appropriate soil conditions?	1	1	0
	Biodiverse	1	1	1
(Santamour, 2004)	Follow the 10-20-30 Rule for Diversity	0	1	0
	Tolerant of Stormwater Inundation	0	1	1
(TAMU, n.d.)	Mulch 2-4"	0	0	0
	TOTAL	6	7	5
	ENVIRONMENTAL CONDITIONS TOTAL	11	19	7
		CAPPA	Library Plaza	Engineering Quad
	TOTAL SCORE	51	58	34

Figure 4-13 Socially Active Climate Resilient Landscape Matrix: Climate Resilience and Total Score

5. Analysis

5.1. Precedent Study Analysis

The information from the precedent studies is categorized into the following nine metrics: Trees, Water, Plant Palette, Pollinators, Carbon, Human Comfort and Behavior, Waste Reduction, Economic and Management. These were subdivided into the three pillars of sustainability: economics, environment and social.

5.2.1. University of Texas at Dallas

Through the University of Texas at Dallas Campus Identity and Landscape Framework Plan the University significantly increased its sustainability. **Environmental impact** was improved through the preservation and enhancement of a campus forest. This forest and other campus trees sequester 154 tons of carbon annually. (Ozdil et al, 2013) Pollinators benefit from a restored Blackland Prairie, monarch waystations, a wildflower meadow, pocket prairie and an apiary. Impervious surfaces were reduced by 49% and composting facilities reduce waste. (UTD, n.d.) Landscape enhancements resulted in **social** benefits through 87% increased positive user perception, 70% reduced stress and better quality of life. Users have access to a community garden and orchard. **Economic** benefits were provided by increased fundraising capacity, job creation and increased enrollment. (Ozdil et al, 2013) The landscape is managed by Dale Bufkin. Dale is an ISA certified arborist, licensed irrigator and has a degree in biology with a minor in horticulture. (UTD, n.d.)

5.2.2. Arizona State University

Arizona State University is a Second Nature signatory and has a page on its website which clearly lays out the university's climate resilience plan and notes goals it has reached. **Environmental** sustainability metrics are achieved through the designation of the campus as an arboretum. The plant palette is comprised of predominately native, drought tolerant, climate adapted plants, and contains no invasive species. ASU is a Bee Campus USA. Community is fostered through volunteer opportunities in orchards, campus cleanups and the rose garden.

5.2.3. Georgia Institute of Technology

Georgia Tech is a Level II Arboretum, and it seeks to achieve 55% tree canopy coverage with 22% woodlands.

There is a landscape architect in the Capital Planning and Space Management Office, and the maintenance team includes an arborist, three horticulturists, a tree crew and a turf manager. (Georgia Tech, n.d.)

5.2. Case Study Analysis

Data released from SmithGroup in 2024 noted that UTA needed more porosity, and a signature outdoor space.

The Engineering Research Quad (ERQ) is mostly absent from the reports with neither comments from students nor any design suggestions. A heat map created from their survey indicates that students use the buildings adjacent to the ERQ but not the space itself. Results also showed that the Nedderman library is a popular space for study and collaboration, which indicates that there is a population nearby who might use the space if it were more inviting.

(SmithGroup, 2024)

5.3. Observational Analysis

Location	Activities	Tree Cover	Seating Options	Conflict	Traces	Notes
Library Plaza	Event tent, Petition, Skateboard, Eat, Study, Relax	Good - Few Missing	Chairs, Concrete Benches, Curbs, Adirondak Chairs, Tables - Everywhere	None. None with Skateboards	Worn	Sense of a lively community space like a city square. Skateboarders exist without apparent conflict
Engineering Quad	Mostly Passing Through, Study, Pace, Socialize	Poor - Small trees, Several Dead, Minimal coverage	Adirondak, Static Benches - with tables, sit walls	Maintenance Vehicles	Broken table	There is little sense of space or community. There are unpleasant views of the parking lot and road. Maintenance vehicles use the road frequently. The buildings do not have a good "front porch". Most of the plants are dead. No "front porch", terracotta pots are empty and in disrepair
CAPPA Courtyard	Study, relax, eat, cross through, Class, events	Moderate - Several trees dead, missing or in decline	Adirondak, Movable Benches - with tables, sit walls, everywhere	Maintenance Vehicles	Tire tracks on grass, rebar	Feels like an active, intimate courtyard. The fountain helps mask other noises. All paths & points of entry are used. Good "front porch" at buildings. Lots of seating options

Figure 5-1 Passive Observational Data

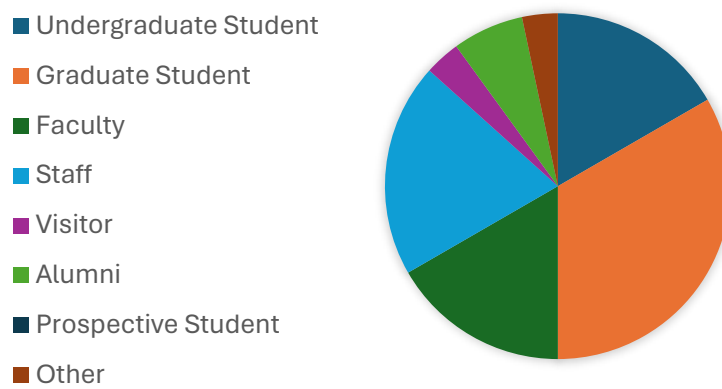
Observations on the UTA campus align with Whyte's data stating that people like chairs they can move. In the CAPPA courtyard the Adirondack chairs were rarely in the same space from day to day and even the bench seats at the tables were occasionally moved around to suit user's needs. The fountain in the CAPPA courtyard is a popular attraction which helps to mask the sounds outside the space. UTA survey respondents listed it as a reason for enjoying the space and observations verified its popularity.

Social Life of Small Urban Spaces claimed that people like to spend time where they can get food and this can be seen on the UTA campus; the most popular spaces, the Library Plaza, Brazos Park and the CAPPa Courtyard are all adjacent to shops where one can purchase food. There is no food, save vending machines, near the Greene Research Quad.

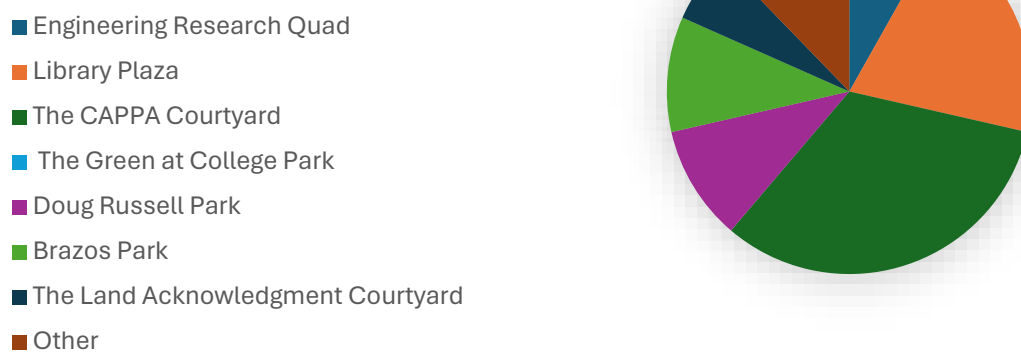
5.4. Survey & Interview Analysis

The survey, *Perceptions of UT Arlington Green Spaces*, was viewed 198 times, with forty-eight responses, twenty-nine of whom completed it. Respondent demographics reflected the population at UTA with 53% female, ethnicities were 56% white, 16% Hispanic or Latino, and 16% Asian. 33% were graduate students.

DEMOGRAPHICS



Where do you like spending time? Select all that apply



In answer to the question “What do you like to do in the Engineering Research Quad? (select all that apply)” 35% of users stated it was nice to walk through and 32% noted that they did not use that space. Thirty percent of respondents checked “I do not go to this space” in answer to the question, “what do you enjoy about the Engineering Quad” and fifteen percent chose “the architecture is attractive.”

The formal interviews with design professionals as well as impromptu discussions with UTA faculty and students guided the research and influenced the creation of the SACR Landscape Matrix and the design of the enhanced Engineering Quad. As a Tarrant County Extension Agent Laura Miller was able to provide resources which were helpful in steering the guidelines in the landscape portion of the matrix, particularly the use of the 10-20-30 rule.

The Institute for Georgia Technical Landscape Architect, Jason Gregory, provided practical recommendations regarding designing for human comfort and design flexibility. A site visit to the campus was not feasible, and Jason was able to provide input on socially active the space was and what activities users engaged in.

5.5. Site Analysis

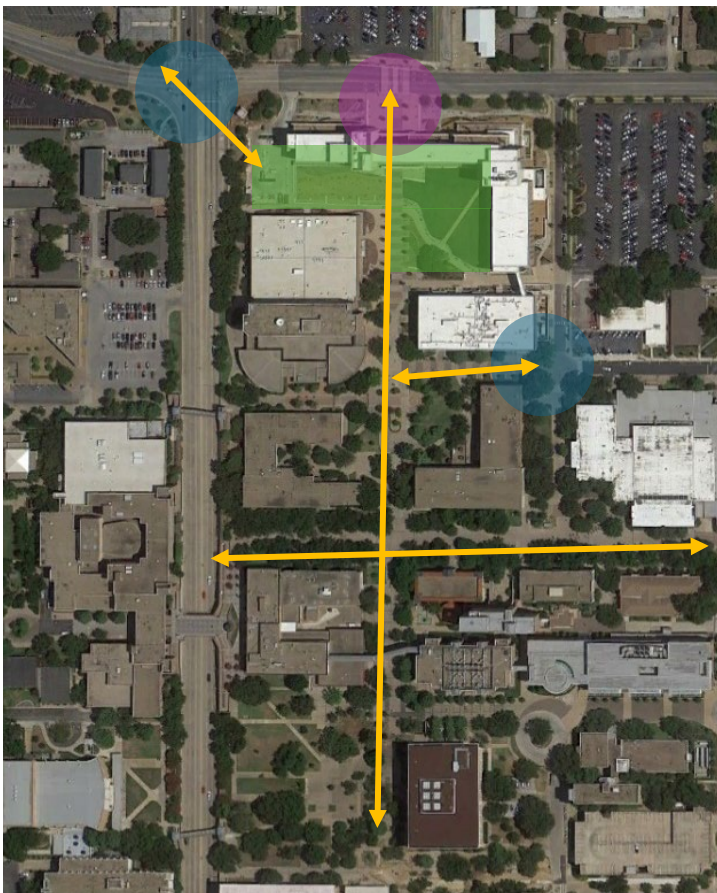


Figure 5-2 Site Context



Figure 5-3 Engineering and Research Quad as designed.

The Greene Research Quad – shown in green in figure 5-3 and enlarged in figure 5-4, with the inclusion of the pedestrian mall which crosses the site, is just under two acres. The Green is half an acre and xeric gravel space is

over a quarter of an acre. The site is accessible by a major pedestrian gateway on the north off UTA Boulevard and another at the corner of Cooper St and UTA Blvd. There is a vehicle drop off point at the east where 1st Street and College Street meet. There are four tables with benches which are bolted to the ground and one of which has some broken slats on the top. Fourteen plastic orange, white, and blue Adirondack chairs are scattered throughout the lawn, which users move as needed. Seat-walls are along the perimeters which visitors were observed to use. There are some large rocks at the entrance to Nedderman Hall on which a student sat and set his backpack on (number five on map below).

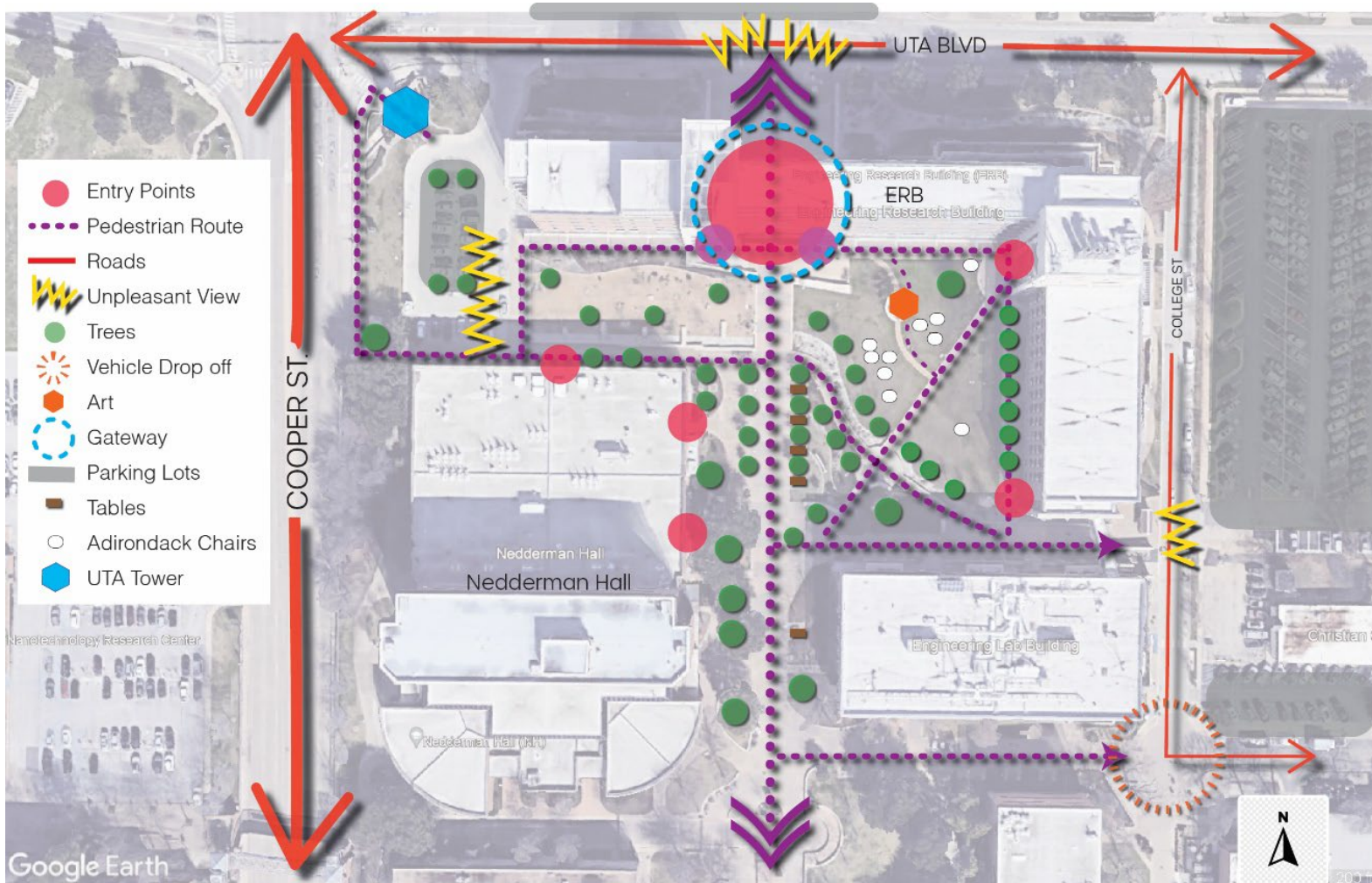


Figure 5-4 Engineering Quad Site Analysis

A minimum of two trees are dead with a few more stressed and not in good health. Maintenance vans and carts often drive through or park in the space under the trees (images 4, 6, and 9 below). The yellow lines in the site analysis map (figure 5-5) illustrate the mostly unobstructed view of parking lots, roads, and traffic. There are no fountains to mask this noise. Aside from seat walls there is no way to interact with the xeric space on the top left

(images 7 & 8). Google Earth images from 2011 shortly after it was completed show a few trees and perennials and decomposed granite in the space; it is now mostly covered in Bermuda grass and weeds. The trees along the pedestrian mall are too small and too far apart to provide shade yet and the trees (a mix of magnolias, bald cypress, and live oaks) in the Research Quad are to the north of the paths and do not offer much shade.



Figure 5-5 Image Context Map

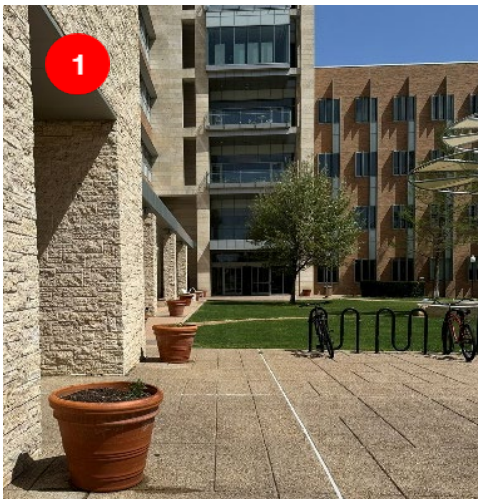


Figure 5-6 ERB Entry

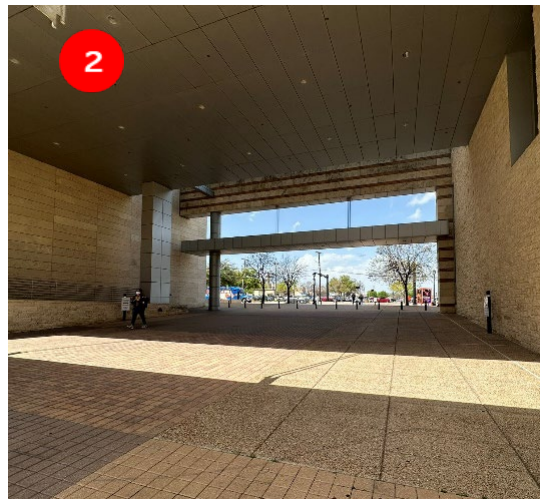


Figure 5-7 ERB Breezeway: No Amenities



Figure 5-8 Windows at ERB: No Seating



Figure 5-9 Entrance to Nedderman Hall & Maintenance Vehicle

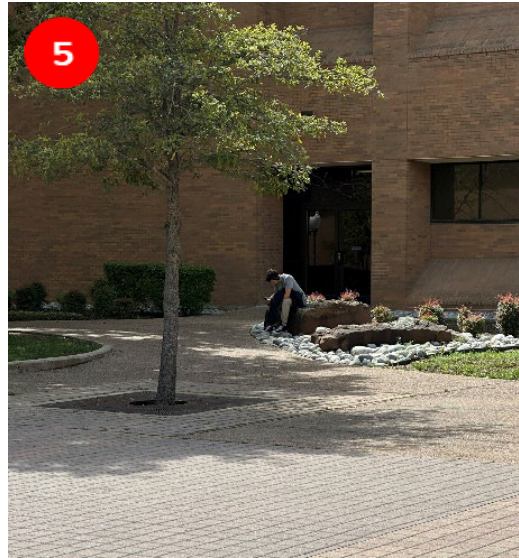


Figure 5-10 Nedderman Hall Entry: No Seats

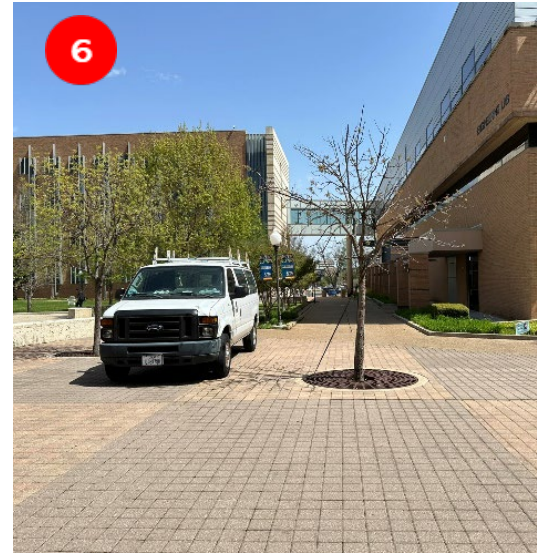


Figure 5-11 Pedestrian Mall: Unhealthy Trees & Maintenance Vehicle



Figure 5-12 View to Cooper & Parking Lot



Figure 5-13 Xeric Garden: Mostly Weeds



Figure 5-14 View North on Pedestrian Mall & Vehicle



Figure 5-15 View Northeast from Table

5.6. Strengths, Weaknesses, Opportunities, & Threats

Strength: The Quad is almost a blank slate, there are no power lines to contend with and the existing path is more than adequate for pedestrians or vehicles to cross; the size of the mall presents an opportunity to cut out a large portion to insert green infrastructure.

Weaknesses: The Engineering Quad lacks a strong focal point, there are few options for users to study, minimal prospect/refuge, and nowhere to get food.

Opportunity: Activating this space could help create a strong feeling of entering a space and a sense of place.

Threats: Budgetary constraints and Climate change in the form of heat, intense storms, and droughts are the biggest threats. As a public university, designs must also contend with changes in the political climate. Because of this design solutions should be presented as not only environmentally sustainable but socially and economically.

6. Design

6.1. Introduction

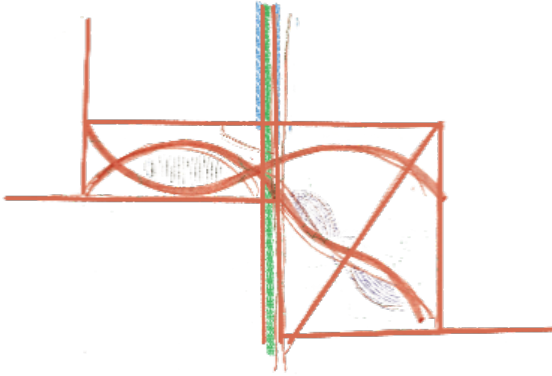


Figure 6-1 Concept.

Two goals led the design process: improve users' experience and increase ecological functions through climate resilience. The Design for Socially Active and Climate Resilient Spaces Matrix was developed in support of and acted as a guide to determine how to achieve those goals. The new design also addressed issues identified by SmithGroup in the Master Plan and sought to keep UTA's mission, vision, values and strategic goals at the forefront of the plan. These

four guiding principles (shown in figure 6-2 below) have a focus on community, collaboration, innovation, and student success. The design reflects these with a goal of enhancing socialization and community, using innovative forward thinking solutions, and collaboration between disciplines and professionals.



Figure 6-12 University of Texas at Arlington: Vision, Values, Mission & Strategic Themes (UTA, n.d.)

6.2. Socially Active Climate Resilient Landscape Design

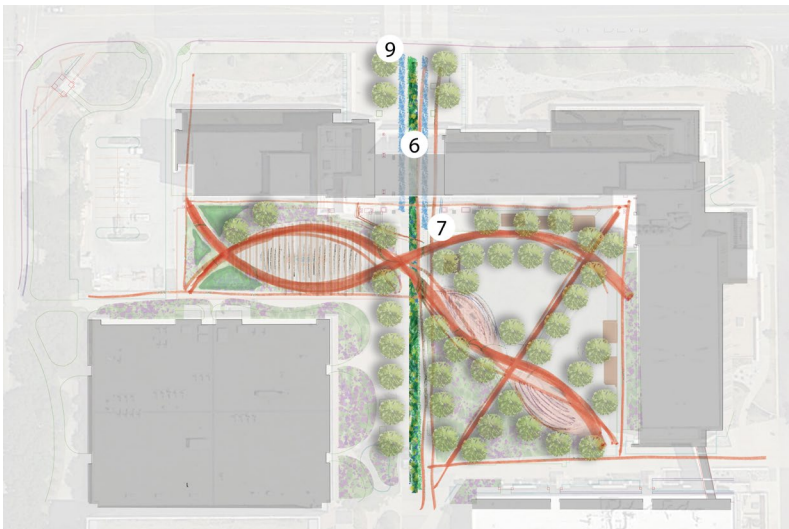


Figure 6-3 Redesigned, Socially Active, Climate Resilient Greene Quad

- | | | |
|----------------------|---------------------------|-----------------------|
| 1. Landscaped Berms | 25. Sculptural Skate Park | 49. Walkways |
| 2. Trellis Courtyard | 26. Tables | 50. Pollinator Garden |
| 3. Artistic Fountain | 27. Bioswale | 51. Linear Fountain |

The new design for the Greene Research Quad includes more hardscaped walkways, pollinator gardens, an artistic fountain, a sculptural skate park, more tables with benches, a bioswale, three berms, a trellis covered courtyard and a linear fountain. These features were chosen with the four sustainable design pillars in mind; they enhance the aesthetic value of the space, provide social benefits, achieve environmental and ecological goals, and due to the reduced costs of maintenance and cooling features they are economically beneficial.

6.2.1 Walkways, Bioswale & Linear Fountain



The walkways (in orange and #7 on the map) were designed to achieve the following goals: facilitate circulation, improve user experience by focusing on the pedestrian scale, and provide an enjoyable user experience. The design retains the primary paths while curvilinear lines break the space into a series of outdoor rooms. The existing walkways were kept as they follow number twelve in the

design matrix: walkways follow the natural desire to take the quickest route. (Marcus & Francis, 1998) An eight-foot-wide bioswale (represented by the vertical green form and #6 on the map) was added to the center of the pedestrian mall starting fifteen feet from the curb of UTA Blvd (see figure 6-4 and 6-5), with ten-foot-wide ADA accessible bridges which cross the bioswale at seventy-foot intervals along the length of the mall. The bridges would allow students, and occasionally maintenance vehicles as needed, to cross from one side to another. The bioswale is a piece of green infrastructure which would hold, absorb, and filter stormwater, increases biodiversity, benefit local fauna, reduce the ambient temperature and provide visual interest to site users. The bioswale would reduce the mall from 29.33' to ten and a half feet on either side and reinforce the pedestrian focus. To add visual interest and mask the sound of traffic a linear fountain (#9 on the map and illustrated in the perspective view in figure 6-5) was added



Figure 6-5 Enhanced Gateway Engineering Quad Entrance on UTA Blvd

parallel to the bioswale. The linear fountain is level to the walkway in order to allow users to move across it. The base of the fountain would be a decorative metal cover which would still look attractive when it is not running. There are breaks along the fountain without water to allow people to cross from one side to another. Both of these features, the bioswale and the fountain, will enhance the entrance to the campus and draw visitors in.

6.2.2 Plant Palette

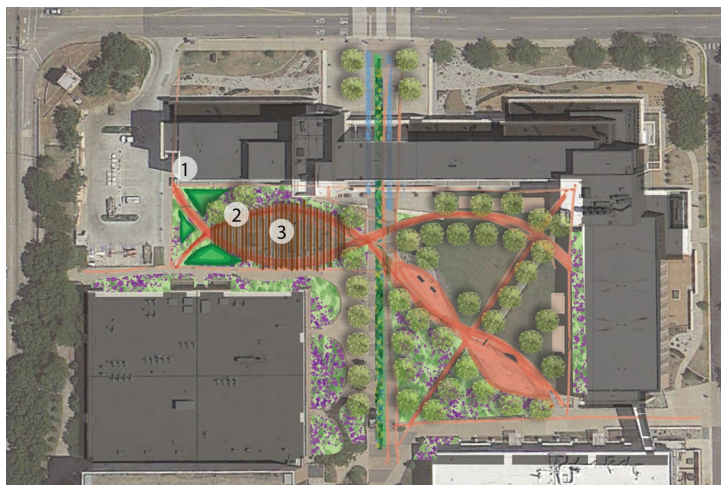


Increased biodiversity and ecological function are achieved through a focus on regionally adapted native plants. Oak trees line the pedestrian mall, desert willow are planted around the shaded courtyard, while the rest of the trees are a mix of, possum haw hollies, cedar elm, eastern red bud and Texas mountain laurel in areas with greater protection from future cold snaps. The pollinator garden, indicated by the number

eight in the map, would contain drifts of turks cap, zexmenia, autumn sage, Russian sage, kidney wood and silver dichondra with their placement determined by the amount of sun or moisture in that location. The trees and perennials have features which are more apparent at different times of the year; this will result in a landscape that provides interest throughout the four seasons.

Signs should be strategically spaced throughout the space to educate users about the enhanced ecological functions. These signs could describe the goals of the project in ways that would appeal to the different colleges at UTA. School of Social Work students could learn about biophilic design and how access to nature can benefit mental health.

6.2.3 Shaded Courtyard, Fountain & Berms



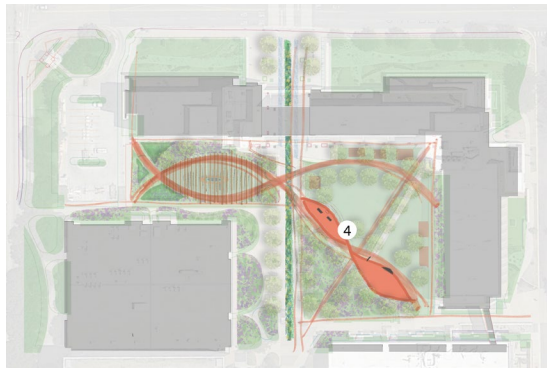
During site visits one was frequently made aware of vehicles whether in the form of the three parking lots at the terminus of each walkway or the roads just past the site boundaries. A courtyard with permeable pavers is shaded by a range of native vines on a large overhead trellis. A mix of passion vine, crossvine, Carolina Jessamine and Coral Honeysuckle provide year-round interest and benefit

multiple pollinators. At the center of the courtyard is an oval fountain which acts as a focal point and helps block the sound of nearby traffic. The newly landscaped space will provide a relaxing view to those inside Nedderman Hall and the Engineering and Research Building. The courtyard will serve as a “porch” and provide comfortable spaces to eat, socialize or study.



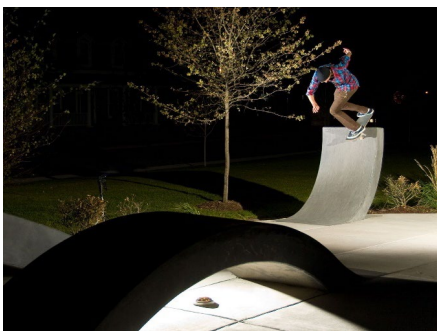
Figure 6-6 Eye of UTA Shaded Courtyard

6.2.4 Sculptural Skatepark



The addition of a skatepark serves several functions. As noted in The Shorthorn article *Skaters kick it up a notch*, there is an active skating community on campus. (Solis, 2024) By providing them with a space to skate they will be less likely to skate on, and wear down, other features on campus. (Rogers, 2018) The design inspiration for the skatepark design came from the Daybreak Sculpture Garden in Utah (images shown in figure 6-6). (Brewer, 2024) The skatepark, designed by Spohn Ranch Skateparks, adds a unique interactive visual element to the landscape. The undulating forms serve the dual function of acting as something for people participating in wheel sports to use and as unique visual artistic elements in the landscape. (Spohn Ranch, n.d.)

The skatepark provides a focal point and gives users a space to engage in activity, which in turn will attract people. In turn others passing through the space may stop, take advantage of the provided chairs, and watch the activity. This cycle of people gathering where other people gather will in turn create a more social outdoor space. When not in use as skate ramps, the structures act as artistic seating and provide visual interest.

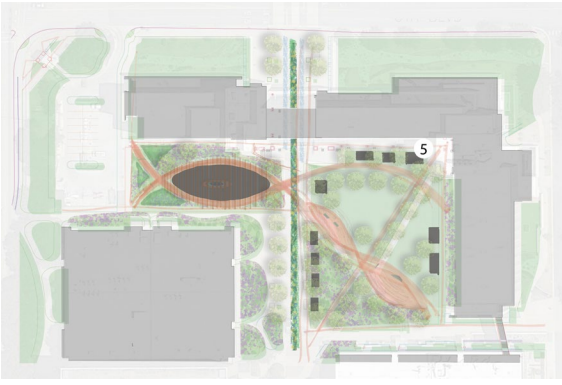


Figures 6-7 Skatepark Inspiration by Spohn Ranch (Brewer, 2024)



Figure 6-8 Skate Park in Southern Portion of Quad looking North at ERB

6.2.5 Tables



Currently, there are only four wooden tables with benches on the western perimeter of the Greene Research Quad parallel to the Pedestrian Mall.

There are chairs which users can move closer to or further from the Mall as they desire. The tables are bolted to the pavers and therefore there are no other options if one wants to use a table. The design proposes hardscaped

spaces with tables and benches on the northern and eastern perimeters of the Greene. These provide a quieter alternative than those next to the Mall and tree and perennials to the south and west of the seating would provide some privacy and shade. The design also includes tables and benches in the Shaded Courtyard for those that want a more community atmosphere.

6.3. Conclusion

The design interventions used were chosen with the goal of increasing user comfort, socialization, and climate resilience by following the Socially Active Climate Resilient Matrix as well as addressing the issues identified in the Master Plan assessment. Table 6-1 illustrates which of the issues identified by SmithGroup for the Masterplan were addressed and how. The user experience will be enhanced with increased seating options, more shade and a skatepark to draw users and provide triangulation. By dividing the space into a series of rooms, users in the Engineering Quad will have a greater sense of safety through enhanced prospect – refuge. Denser landscaping and shaded seating will increase the feeling of refuge while not being so thick that they cannot see others around them. Chapter seven section seven-two tests the proposed design against current conditions.

Issue Addressed	Design Intervention
Improve First Impression	Enhanced entrance off UTA Blvd
Sense of Identity	The unique site-specific design will become an iconic campus space full of activity
Outside Appearance	Designed with the goal of improving the view of users looking out from the surrounding buildings, as well as those entering and passing by the space from Cooper and UTA Blvd.
Improve Mobility	Shaded walkways at a pedestrian scale with improved landscaping will provide a more enjoyable pedestrian experience
Increase Usable Spaces	Developing the xeric space and the lawn increases the number of activities that can take place
Focus on Key Buildings	The design enhances the Engineering and Research Building
Signature Space	An artistic skatepark surrounded by diverse plants with an emphasis on season interest
Expand Recreation	The introduction of the skatepark creates a welcoming space for alternative recreation
More Research Space	An Innovative Design with a focus on education and post occupancy evaluation will provide an opportunity to study climate resilient landscapes and human socialization

Figure 6-9 Issues Addressed Through New Design

7. Conclusion

7.1. Research Questions Revisited

The matrix created provides a set of guidelines to answer the question “How can campus landscape design positively address the design principles for both social interaction and climate resilience?” and “What are the design principles for socially active outdoor spaces that are best suited for a college campus?”

To answer the second question, “What are the guidelines for a climate resilient landscape in North Texas?”, one should follow the motto “Right Plant, Right Place”. Simply using native or xeric plants does not equal a resilient landscape. They must be the right plant for the specific conditions with considerations for maintenance constraints such as time and staffing as well as the conditions under which the plant was grown. In addition, using the 10 - 20 - 30 rule will help to guarantee adequate biodiversity ensuring that if one species succumbs to a pathogen then the site will not be bare. Finally, one must keep in mind that landscapes are evolving spaces and will require occasional evaluation by maintenance and design professionals to ensure they are meeting the needs of the campus.

7.2. Test

As noted in *Streetscape Greenery and health: Stress, Social Cohesion and Physical Activity as Mediators*, increased quantity and quality of green streetscapes result in improved levels of health, decreased stress and greater social cohesion. (de Vries, 2013) Therefore, it follows that healthy climate resilient greenspaces at UTA will lead to improved mental and physical health of students, staff, and visitors.

The Socially Active Climate Resilient Landscape matrix was used to evaluate the design which indicated a score of seventeen points above the current environmental conditions and an improvement of thirteen points on design and human behavior and with an overall improvement of twenty-eight points. Some measures, such as how frequently it is occupied, whether there are user conflicts and if mulch has been properly applied cannot be measured until after the design has been implemented. These are marked on the post matrix as **too early*. Tree health cannot be rated until the design is installed, but landscape improvements will result in an increase of five

points (see figure 7-3). Even with some measurements still early to tell, the design shows an overall improvement by thirty points (figure 7-4).

Site Furnishings improvements resulted in an improvement of three points as illustrated in figure 7-2. This gain was achieved not only by adding more tables but with consideration for where they were placed, as advised in *People Places: Design Guidelines for Urban Open Spaces*. The enhanced Engineering Quad design calls for tables and more seating along the north and east portions of the Quad and under the trellis covered courtyard on the western portion.

7.3. Future Research

Future research should include a post occupancy evaluation as suggested in *People Places* to see if the space has enhanced socialization and community. This would be a great opportunity for different colleges at UTA to use the space as a case study and living laboratory. Landscape architecture students could visit the Quad for Plant Ecology classes and the Sustainability Undergrad could evaluate the features. An on-site survey should be conducted, using the advice given by Erik Trevino to ask users what words, from a provided word bank, do they think best describes the space.

Studying perceptions and behaviors of campus users in the face of climate change would be another topic for future research. In the face of hotter temperatures and virtual reality do users still enjoy the outdoors?

Finally, it would be helpful to conduct two focus groups. One with Engineering Research Building users; does the view of and the opportunity to walk through the enhanced landscape affect their mood or performance? The second group should be with and about skateboarders; do the skateboarders use the space? Do students and faculty coexist with them well or are there conflicts? What are the positive and negative unintended consequences?

7.4. Relevance to Landscape Architecture

For economic, social, and environmental reasons sustainability is an issue of growing popularity for landscape architects and those they serve. The Matrix, provided in full in Appendix D, is an easy-to-follow guide to determine not just whether a proposed or existing design looks good, but if it will successfully enhance socialization and community and stand the test of time. There is currently no tool that industry professionals or laypeople can use to

easily access a site or design. With the growing urgency to respond to the threats of climate change this Matrix will provide an invaluable tool to help users create climate resilient spaces.

The creation of a mobile application would facilitate the use of the Socially Active Climate Resilient Landscape Matrix and would make this accessible to landscape designers, maintenance personnel and laypeople. By virtue of simplicity and avoiding jargon the Matrix can easily be shared with those outside of the landscape architecture profession such as university staff, grounds maintenance personnel, students, and visitors.

CITATION	METRIC	SCORE	
		EXISTING	PLANNED
DESIGN & HUMAN BEHAVIOR			
	Human Behaviour		
(Zeisel, 2006)	Frequently Occupied	2	<i>*Too Early</i>
(Zeisel, 2006)	Diverse Activities	1	2
(Zeisel, 2006)	Demographic Diversity	2	<i>*Too Early</i>
(Zeisel, 2006)	No User Conflicts	1	<i>*Too Early</i>
	TOTAL	6	<i>*Too Early</i>
	Site Furnishings		
(Marcus & Francis, 1998)	Bicycle Racks	2	2
(Marcus & Francis, 1998)	Adequate Safety Call Boxes	2	2
(Marcus & Francis, 1998)	Tables for eating & studying	1	2
(Marcus & Francis, 1998)	Seating options for individuals, or groups of various sizes	2	2
(Marcus & Francis, 1998)	Enough waste receptacles	1	2
(Marcus & Francis, 1998)	Seating Variety to Allow for a Diverse Activities in Varying Group Sizes	1	2
	TOTAL	9	12
	DESIGN & HUMAN BEHAVIOR TOTAL	26	<i>*39</i>

Figure 7-1 Human and Site Furnishings Results

	CITATION	METRIC	SCORE	
			EXISTING	PLANNED
DESIGN & HUMAN BEHAVIOR				
		Design		
1	(Marcus & Francis, 1998)	Spaces at Building Entrances to Study & Socialize	0	2
2	(Marcus & Francis, 1998)	Shade plants, Structures, or other methods to cool users	0	2
3	(Marcus & Francis, 1998)	ADA Accessible	1	2
4	(Marcus & Francis, 1998)	The Space is Well Lit at Night	2	2
5	(Marcus & Francis, 1998)	Adequate Wayfinding	2	1
6	(Marcus & Francis, 1998)	Walkways Accommodate Pedestrians & Other Modes of transportation	2	2
7	(Marcus & Francis, 1998)	Space is Large enough for events but Does not seem empty Otherwise	0	2
8	(Marcus & Francis, 1998)	Eye catching feature or Focal Point	0	2
9	(Marcus & Francis, 1998)	Multiple events Can Occur at once such as studying, recreation and socializing	1	2
10	(Marcus & Francis, 1998)	Seating Options Away From Main Path	0	2
11	****	CPTED Safety: Visibility	2	2
12	(Marcus & Francis, 1998)	Walkways follow the natural desire to Take the quickest route	2	2
13	(Marcus & Francis, 1998)	Indoor Spaces Coordinated with the Outside Landscape to Provide a Visually Pleasing Connection	0	2
14	(Marcus & Francis, 1998)	Informative Educational Signs	0	2
15	(Marcus & Francis, 1998)	Plan for postoccupancy evaluation	0	*Too Early
16	(Marcus & Francis, 1998)	Can the budget maintain this space?	0	*Too Early
		TOTAL	11	*27

Table 7-2 Design Metric Results

CITATION	METRIC	SCORE		
		Current	Design	Post Occupancy
Environmental Conditions Score				
	Tree Health			
(MacDonagh, 2020)	Presence of Trunk Flare			
(MacDonagh, 2020)	Round or Oval Tree Canopy			
(MacDonagh, 2020)	Dense Tree Canopy			
(MacDonagh, 2020)	Mulch in an Even Layer - Not Around Base of Tree			
(MacDonagh, 2020)	Surface Roots that Radiate Outwards			
(MacDonagh, 2020)	Healthy Branches: None Broken, Missing Bark Nor Any Fungus			
(MacDonagh, 2020)	Roots: No fungus, cavities, compaction			
(MacDonagh, 2020)	Trunk: No Cracks, wounds, fungus, missing bark			
(MacDonagh, 2020)	No Codominant Branches			
	Trees on the south side of features such as sidewalks and seating areas to provide optimal shade.			
	TOTAL			
	ENVIRONMENTAL CONDITIONS TOTAL			
		Current	Design	Post Occupancy
	TOTAL SCORE			

Table 7-3 Environmental Conditions: Tree Health

	Climate Resilience		
(Lunday, 2022)	Drought Tolerant Plants	1	2
	Freeze Tolerant of Local Conditions	0	2
(Lunday, 2022)	Heat Tolerant of Local Conditions	1	2
	No Known Disease or Pest Alerts *if pathogens exist, plant species should be used sparingly	1	2
(Lunday, 2022)	Prioritize Native Plant Specites	0	2
	Right Plant Right Place: Are the plants in the correct growing conditions such as sun, shade or appropriate soil conditions?	1	2
	Biodiverse	0	2
(Santamour, 2004)	Follow the 10-20-30 Rule for Diversity	0	2
	Tolerant of Stormwater Inundation	0	2
(TAMU, n.d.)	Mulch 2-4"	0	*Too Early
	TOTAL	4	18
	ENVIRONMENTAL CONDITIONS TOTAL	7	24
		EXISTING	PLANNED
	TOTAL SCORE	33	63

Table 7-4 Environmental Conditions: Landscape and Climate Resilience

Appendices

Appendix A: Internal Review Board: Approval

Good afternoon,

You are receiving this email because one of your human subject research studies is approved under the UTA IRB's Minimal Risk Internal "Flex" Review Category and this study is coming up on its anniversary date. *To determine which of your approved studies pertains to this message, log into Mentis <https://mentis.uta.edu/public/> and access the IRB from menu on left. Select "Approved Protocols" under "My Activity" and look for the study (or studies) that have "Minimal Risk" listed as the Review Type and an Anniversary Date within the next 30 days.*

As a reminder, this Minimal Risk study is not required to submit annual continuing reviews. There is nothing you need to do at this time to maintain continued IRB approval.

However, under [UTA's IRB Policy and Operating Procedures](#), you still have responsibilities and obligations to fulfill as Principal Investigator of this study - please review them below.

1. You must let us know **immediately** if this study has received, or will receive, **any funding from federal sources** (including NIH, DHHS, NSF, DOD, DOT, DOJ, DOE, DoED, etc). This includes any pending or future grant proposals for this project that involve federal funding sources. Expedited level studies with federal funding approved prior to January 21, 2019 must continue to submit annual continuing reviews per the pre-2018 federal regulations.
2. If your study receives federal funding **at a later date**, or if you intend to apply for future federal funding for this study in the future, you must inform the IRB office **immediately** so that we can ensure that the correct federal regulations are applied to the study at that time. ***Failure to notify Regulatory Services of federal funding may cause your study to be non-compliant with federal regulations and may impact future federal funding.***
3. Please note that even though your study no longer requires annual continuing reviews, **all proposed changes to the study must still be submitted via a modification request** in the electronic submission system and approved by the IRB prior to implementation. Implementing changes without IRB approval is considered non-compliance. In addition, all unanticipated problems (events that are unexpected, possibly related to the research, and place subjects or others at greater risk of harm) must be reported to the IRB within 5 days.
4. You are required to notify Regulatory Services once your study is completed to begin the required 3-year research record retention period. **You may close out the protocol once recruitment, subject follow up, data collection, and data analysis is complete.**

Although annual continuing review will no longer be required for most approved minimal risk studies, you will receive an email each year around the anniversary date of your initial approval – **that's what this email is!** This email will serve as a reminder of your obligations as Principal Investigator of an ongoing research study (outlined above and according to [IRB Operating Procedures](#)).

Please feel free to let us know if you have any questions about this email, or if you have any questions about the responsibilities listed above.

All the best,

LISA ALVAREZ

IRB Specialist

Office of Regulatory Services

Lisa.Alvarez@uta.edu

Direct: 817-272-9329

Office: 817-272-3723

<https://resources.uta.edu/research/regulatory-services/human-subjects/index.php>

Chat with me on Teams or email regulatoryservices@uta.edu to request a virtual meeting or phone call!

Appendix B: Interview Cover Letter

Hello ____,

I am a graduate student at the University of Texas at Arlington, and I am recruiting for a research study. I am studying landscape architecture, and I am currently conducting research for my thesis on fostering socialization and community through climate resilient landscapes for north Texas universities. I am reaching out to see if you would be interested in participating in an interview as part of my thesis research. Ultimately the information gathered will be used to create a new design for a portion of the UTA campus and facilitate transitioning the campus landscape to one that can thrive in the extreme weather patterns we face while being an attractive inviting space at the same time. This information, and the resulting climate resilient campus landscape would serve as an example for surrounding communities and other public universities.

My methodology includes recruiting industry professionals to interview for my research study to collect data. Your experiences and insight would be valuable. Therefore, I am hoping to have you participate in an interview on this subject. It would take about 1 hour and will be solely about the topics of landscapes suited to withstand extreme weather conditions, how landscapes are maintained and how best to implement them. If you are able to meet, please let me know your availability so that we can meet at your earliest convenience.

I am grateful for any of your time and knowledge which you are willing to share.

Thank you in advance,

Melissa Brown

The University of Texas at Arlington | CAPPA

Master of Landscape Architecture Thesis Candidate | 2024

Appendix C: Condensed Minimal Risk Consent Form

My name is Melissa Brown, and I am asking you to participate in a UT Arlington research study titled, “Landscape Design That Enhances Socialization and Community Through Climate Resilience; Guidelines for North Texas Universities” This research will study the intersection between socially active public spaces and those that are suited to withstand the challenges of global climate change on university campuses. This information will be used to create a set of guidelines to determine whether a site is socially active and climate resilient as well as design future projects. You can choose to participate in this research study if you are at least 18 years old and have spent time in a university campus landscape or if you have experience with climate resilient landscapes.

Reasons why you might want to participate in this study include the chance to contribute your unique experiences or knowledge of the study of socially active climate resilient landscapes on university campuses. This information will be used to influence the design of spaces at UTA and other university campuses. You might not want to participate if you feel your expertise may not contribute to this topic or you are not able to commit to a one-hour interview with a potential follow-up email or interview. Your decision about whether to participate is entirely up to you. If you decide not to be in the study, there won't be any punishment or penalty; whatever your choice, there will be no impact on any benefits or services that you would normally receive. Even if you choose to begin the study, you can also change your mind and quit at any time without any consequences.

If you decide to participate in this research study, the list of activities that I will ask you to complete for the research, include scheduling an interview with me at your convenience and answer questions related to the purpose of this study and within your field of expertise. The interview may be conducted in person or through TEAMS online video conferencing software (whichever is most convenient for you). This interview will be recorded with your permission to facilitate the opportunity to playback our conversation when integrating it into this study. It should take about an hour for the initial interview. There will potentially be a request for a follow-up interview or email exchange based on new knowledge gained and new questions raised throughout the course of this study. After my research is completed, I will contact you to get your feedback on my guidelines and feedback. The feedback would be via email or in person, whichever is more comfortable for you. Your feedback will be anonymous unless you state otherwise. The feedback would say something to the effect that “this design was shown to several industry professionals who have determined that it meets the stated goals”. If you do not wish to remain anonymous your name might appear with your title and current place of employment and a summary of feedback you might have. . Although you probably won't experience any personal benefits from participating in the study activities are not expected to pose any additional risks beyond those that you would normally experience in your regular everyday life.

You will not be paid for completing this study. There are no alternative options to this study project.

There is a potential risk to loss of privacy and confidentiality related to this research; however, the research team is committed to protecting your rights and privacy as a research subject. (1) If you consent to publication of your name and any other identifiable data you choose (such as the name of your organization, contact information, etc.), this information will be included for citation purposes when incorporating your expertise into this study and linked to your specific contribution. There is the potential that your professional reputation may be impacted, as this study will potentially be utilized by designers, planners, and policy makers to inform best practices when designing and planning this type of landscape. As noted above, you have the option to remain anonymous, in which case no identification data will be published as part of this research. (2) There is a risk of data breach as the identifiable data will be stored in a secure UTA OneDrive account. To minimize this risk, IRB protocol and recommendations for storage of electronic data will be followed, and all electronic data (including audio/visual recordings) collected from this study will be stored in a secure location on the UTA campus and/or secure UTA server for three years after the end of this research, at which point it will be deleted. (3) There may be questions asked as part of the expert interview that may make you feel uncomfortable

or that you feel are private. As stated above, you will be provided with the list of questions prior to your interview being conducted. Your answers will be at-will, and you will not be forced to answer any questions that you feel would compromise your privacy in any way. (4) You may feel uncomfortable discussing the information requested in certain settings. As stated above, it is your choice as to the mode (i.e., in-person, online through TEAMS) and location for the interview that best supports your privacy.

The research team is committed to protecting your rights and privacy as a research subject. We may publish or present the results, but your name (and other identifiable data you choose, such as your organization, contact information, etc.) will only be used with your consent. If you do consent use of your name and/or other identifiable information, we will only use it for citation purposes when incorporating your expertise into this study. While absolute confidentiality cannot be guaranteed, the research team will make every effort to protect the confidentiality of your records as described here and to the extent permitted by law. If you have questions about the study, you can contact me, Melissa Brown, at Melissa.brown6@mavs.uta.edu or my Academic Advisor, Diane Jones Allen (diane.allen@uta.edu). For questions about your rights or to report complaints, contact the UTA Research Office at 817-272-3723 or regulatoryservices@uta.edu.

You are indicating your voluntary agreement to participate by signing on the line below.

Signature: _____ Date: _____

Printed Name: _____

I ___ consent ___ do not consent (initial one preference) to publication of my identifiable data as described above. [Please note, if you consent to publication of your identifiable data, we will clarify with you how this data should be formatted and what should be included.]

I ___ consent ___ do not consent (initial one preference) to my interview being recorded only for use and reference of Melissa Brown and Diane Jones Allen while analyzing and synthesizing my expert input as part of this study.

Appendix D: Socially Active Climate Resilient Landscape Design Matrix

CITATION	METRIC	SCORE		
		Current	Design	Post Occupancy
DESIGN & HUMAN BEHAVIOR				
	Design			
(Marcus & Francis, 1998)	Spaces at Building Entrances to Study & Socialize			
(Marcus & Francis, 1998)	Shade plants, Structures, or other methods to cool users			
(Marcus & Francis, 1998)	ADA Accessible			
(Marcus & Francis, 1998)	The Space is Well Lit at Night			
(Marcus & Francis, 1998)	Adequate Wayfinding			
(Marcus & Francis, 1998)	Walkways Accommodate Pedestrians & Other Modes of transportation			
(Marcus & Francis, 1998)	Space is Large enough for events but does not seem empty Otherwise			
(Marcus & Francis, 1998)	Eye catching feature or Focal Point			
(Marcus & Francis, 1998)	Multiple events Can Occur at once such as studying, recreation and socializing			
(Marcus & Francis, 1998)	Seating Options Away from Main Path			
****	CPTED Safety: Visibility			
(Marcus & Francis, 1998)	Walkways follow the natural desire to Take the quickest route			
(Marcus & Francis, 1998)	Indoor Spaces Coordinated with the Outside Landscape to Provide a Visually Pleasing Connection			
(Marcus & Francis, 1998)	Informative Educational Signs			
(Marcus & Francis, 1998)	Plan for post occupancy evaluation			
(Marcus & Francis, 1998)	Can the budget maintain this space?			
	TOTAL			
	Human Behavior			
(Zeisel, 2006)	Frequently Occupied			
(Zeisel, 2006)	Diverse Activities			
(Zeisel, 2006)	Demographic Diversity			
(Zeisel, 2006)	No User Conflicts			
	TOTAL			
	Site Furnishings			
(Marcus & Francis, 1998)	Bicycle Racks			
(Marcus & Francis, 1998)	Adequate Safety Call Boxes			
(Marcus & Francis, 1998)	Tables for eating & studying			
(Marcus & Francis, 1998)	Seating options for individuals, or groups of various sizes			
(Marcus & Francis, 1998)	Enough waste receptacles			
(Marcus & Francis, 1998)	Seating Variety to Allow for a Diverse Activities in Varying Group Sizes			
	TOTAL			
	DESIGN & HUMAN BEHAVIOR TOTAL			

Rating System	
Category	Score
Poor/None	0
Partial/Adequate	1
Existing/Good	2
	*Too Early

CITATION	METRIC	SCORE		
		Current	Design	Post Occupancy
Environmental Conditions Score				
	Tree Health			
(MacDonagh, 2020)	Presence of Trunk Flare			
(MacDonagh, 2020)	Round or Oval Tree Canopy			
(MacDonagh, 2020)	Dense Tree Canopy			
(MacDonagh, 2020)	Mulch in an Even Layer - Not Around Base of Tree			
(MacDonagh, 2020)	Surface Roots that Radiate Outwards			
(MacDonagh, 2020)	Healthy Branches: None Broken, Missing Bark Nor Any Fungus			
(MacDonagh, 2020)	Roots: No fungus, cavities, compaction			
(MacDonagh, 2020)	Trunk: No Cracks, wounds, fungus, missing bark			
(MacDonagh, 2020)	No Codominant Branches			
	Trees on the south side of features such as sidewalks and seating areas to provide optimal shade.			
	TOTAL			
ENVIRONMENTAL CONDITIONS TOTAL				
		Current	Design	Post Occupancy
TOTAL SCORE				

CITATION	METRIC	SCORE		
		Current	Design	Post Occupancy
Environmental Conditions Score				
	Landscape			
	No Invasive species: Vitex agnus-castus, Ligustrum lucidum, Ligustrum sinense, Nandina domestica, Photinia x fraseri			
	Seasonal Interest			
(PGMS, nd)	Plant Materials Are Thriving, & Require Little Maintenance			
(PGMS, nd)	Planting Areas Are Properly Mulched			
(PGMS, nd)	Biodiverse Plant Palette			
TOTAL				
	Climate Resilience			
(Lunday, 2022)	Drought Tolerant Plants			
	Plants Tolerant of Possible Freeze Conditions			
(Lunday, 2022)	Heat Tolerant of Local Conditions			
	No Known Disease or Pest Alerts *if pathogens exist, plant species should be used sparingly			
(Lunday, 2022)	Prioritize Native Plant Specites			
	Right Plant Right Place: Are the plants in the correct growing conditions such as sun, shade or appropriate soil conditions?			
(Santamour, 2004)	Follow the 10-20-30 Rule for Diversity			
	Tolerant of Stormwater Inundation			
(TAMU, n.d.)	Mulch 2-4"			
TOTAL				
ENVIRONMENTAL CONDITIONS TOTAL				
		Current	Design	Post Occupancy
TOTAL SCORE				

CITATION	METRIC	SCORE		
		Current	Design	Post Occupancy
Environmental Conditions Score				
	Tree Health			
(MacDonagh, 2020)	Presence of Trunk Flare			
(MacDonagh, 2020)	Round or Oval Tree Canopy			
(MacDonagh, 2020)	Dense Tree Canopy			
(MacDonagh, 2020)	Mulch in an Even Layer - Not Around Base of Tree			
(MacDonagh, 2020)	Surface Roots that Radiate Outwards			
(MacDonagh, 2020)	Healthy Branches: None Broken, Missing Bark Nor Any Fungus			
(MacDonagh, 2020)	Roots: No fungus, cavities, compaction			
(MacDonagh, 2020)	Trunk: No Cracks, wounds, fungus, missing bark			
(MacDonagh, 2020)	No Codominant Branches			
	Trees on the south side of features such as sidewalks and seating areas to provide optimal shade.			
	TOTAL			
	Landscape			
	No Invasive species: Vitex agnus-castus, Ligustrum lucidum, Ligustrum sinense, Nandina domestica, Photinia x fraseri			
	Seasonal Interest			
(PGMS, nd)	Plant Materials Are Thriving, & Require Little Maintenance			
(PGMS, nd)	Planting Areas Are Properly Mulched			
(PGMS, nd)	Biodiverse Plant Palette			
	TOTAL			
	Climate Resilience			
(Lunday, 2022)	Drought Tolerant Plants			
	Plants Tolerant of Possible Freeze Conditions			
(Lunday, 2022)	Heat Tolerant of Local Conditions			
	No Known Disease or Pest Alerts *if pathogens exist, plant species should be used sparingly			
(Lunday, 2022)	Prioritize Native Plant Specites			
	Right Plant Right Place: Are the plants in the correct growing conditions such as sun, shade or appropriate soil conditions?			
(Santamour, 2004)	Follow the 10-20-30 Rule for Diversity			
	Tolerant of Stormwater Inundation			
(TAMU, n.d.)	Mulch 2-4"			
	TOTAL			
	ENVIRONMENTAL CONDITIONS TOTAL			
		Current	Design	Post Occupancy
	TOTAL SCORE			

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