EEP

04

Current & Future Conditions

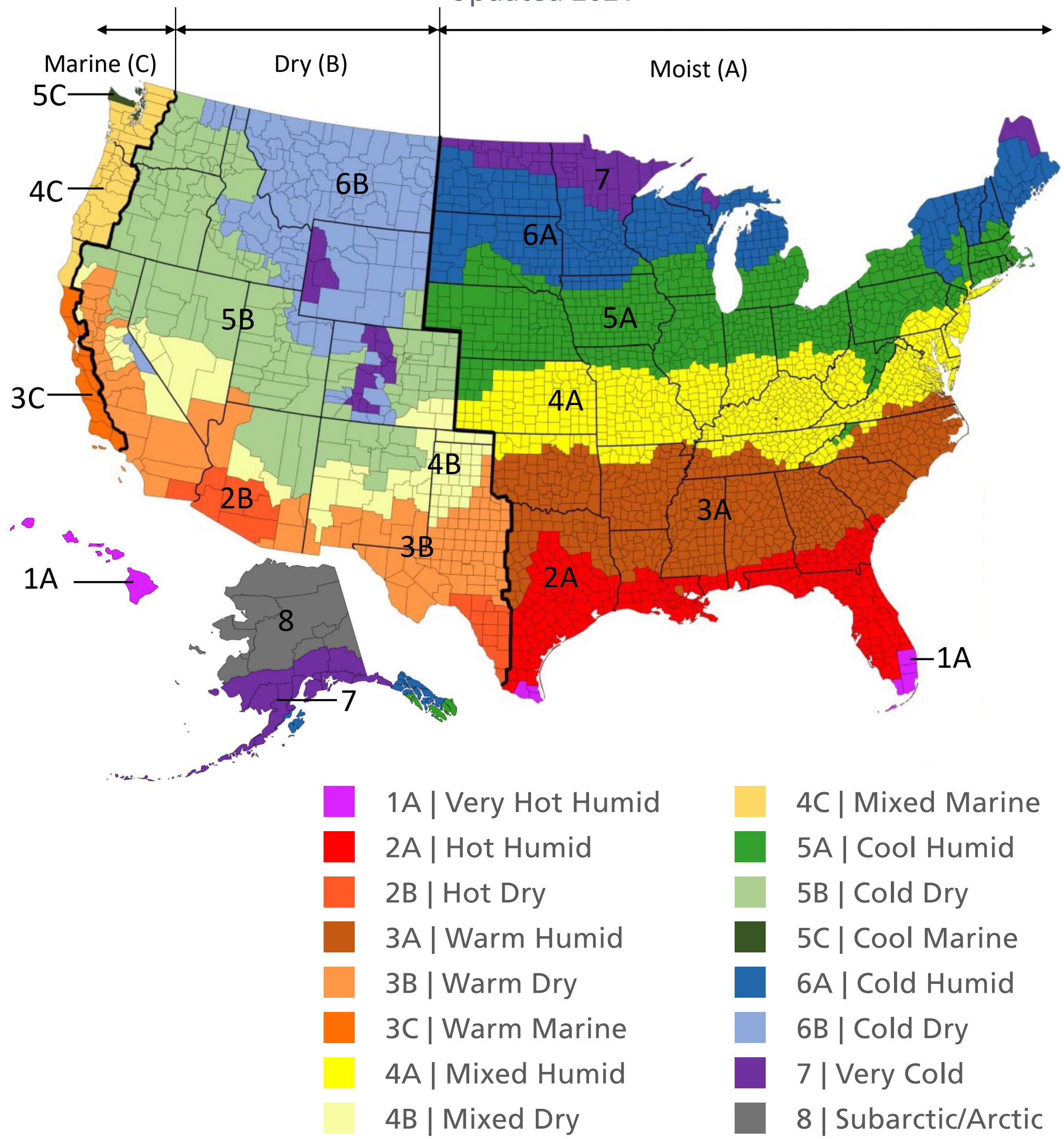
This plan's approach to infrastructure modernization and resilience begins with a comprehensive understanding of how climate patterns affect daily campus life. From student comfort to infrastructure demands, climate conditions and the need for resilience in Texas are interrelated and will shape the present and future of the university's operational requirements.

UTA

Climate Conditions

The DFW area experiences a humid subtropical climate (represented by IECC Climate Zone 2A), characterized by hot summers and mild winters. Summer highs average between 85-93°F, and maximum temperatures often exceed 100°F. Winters typically bring about lows that fall between 39-52°F, with the potential for extreme cold that can dive into negative digits. Moderate rainfall usually occurs during seasonal shifts (typically in the months of May and October), with occasional light snowfall in winter months. The region experiences pleasant weather during the spring and fall seasons.[2,3]

IECC Climate Zones
Updated 2021



Source: US DOE

2 Dallas/Fort Worth Climate Narrative

3 NOWData | NOAA - NWS

Forever Cooling

The cooling season in the region is long, typically starting in Spring and extending into early Fall. Extreme heat during the summers necessitates the use of air conditioning to maintain comfortable indoor environments for the campus community. The high humidity also makes walking outdoors around the campus uncomfortable and necessitates the use of dehumidification in indoor cooling systems. The campus is still operational in the summer for research, short courses and events requiring buildings without occupancy sensors and humidity control to fully operate chillers to avoid damage due to mold and humidity. This extended period of full cooling thermal demand results in high energy costs as it also coincides with higher energy rates during the summers and potentially straining power distribution infrastructure. This can also have a waterfall effect on the grid infrastructure within and outside of UTA, and possibly the wider city power networks.

The Need for Heat

Heating thermal demand on campus is expectedly driven by the relatively mild winters. While the cold season is not as long, heat demand across the campus throughout the year persists from heating loads for athletics, research labs, and healthcare facilities. Natural gas is used to meet all heating demands on campus through boilers at the Central Plant and distributed via a district loop. Heating demand in the future could also likely reduce as winter average temperatures increase.

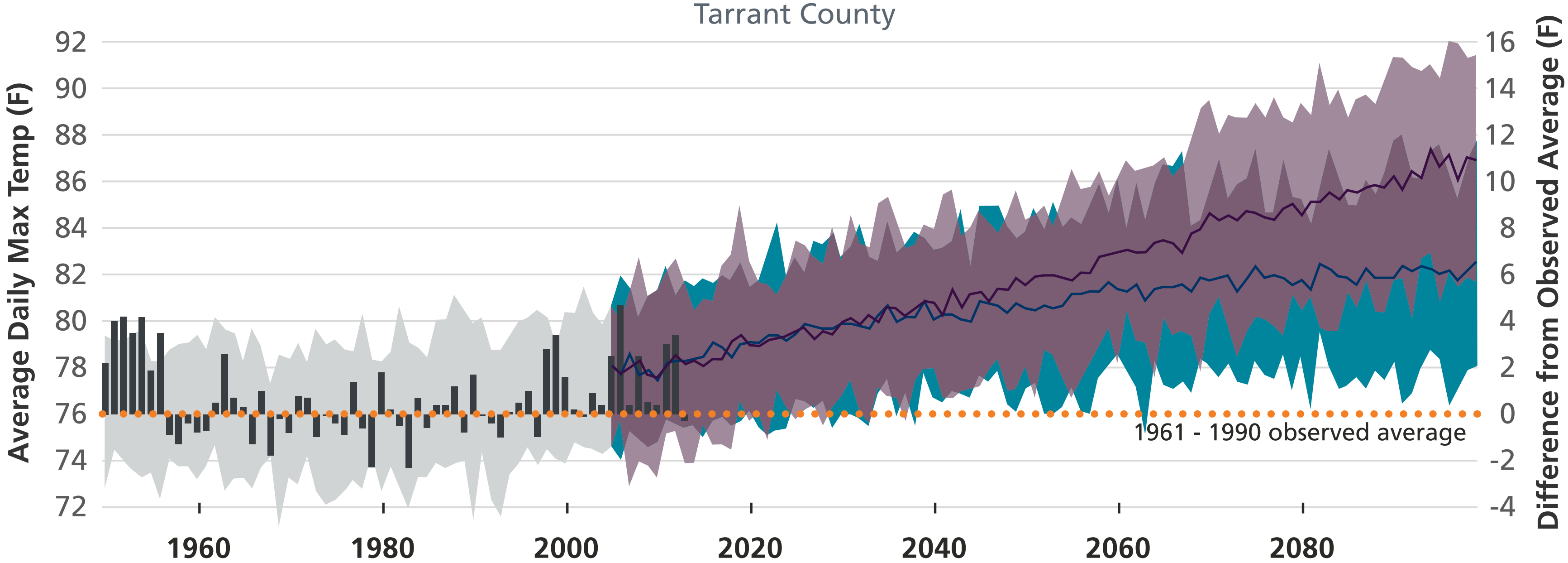
What have we learned?

UTA can be best prepared for extreme temperatures by:

- Increasing shading by planting trees and using artificial shade structures
- Using of misting machines for high traffic outdoor walking paths
- Creating maps with shortest path routes for visitors and campus community
- Designing thermal systems at buildings to consider future climate conditions
- Providing access to cooling centers and water dispensers during severe heat emergencies

Average Daily Maximum Temperature

Tarrant County



Adapted from Climate Explorer

Projections for Mid-Century (2035 - 2064)

Higher Emissions Scenario

135.9

Annual Days Max Temp >90F

111.1°F

Annual Single Highest Max Temperature

Microgrids can provide additional resilience on campus and provide a great opportunity to teach students alternative ways to power the future.

Securing Energy Resilience

Texas is the only state to operate its own power grid; it doesn't have significant interconnections to the grids serving the eastern and western grids of the country. The Texas Interconnection is managed by the Electric Reliability Council of Texas (ERCOT) and is responsible for power dispatched by 1,250 power generation units through 54,100 miles of transmission lines to more than 27 million customers.[4]

Without major interconnections to other grid operators across the country, the state cannot import power leaving it susceptible to outages and failures during weather or grid emergency events. Texas utility companies have interstate links allowing them to import and export power as and when needed. However, the grid as we know it was not built to withstand the stressors it faces today and in the future. This unfortunately has already become a reality in recent years.

Texas had the most weather-related power outages, 210 to be precise, between 2000 to 2023, as per the nonprofit Climate Central based on power outage data from the U.S. Department of Energy.[5] The frigid temperatures brought about during the Great Freeze in 2021 resulted in power generation outages and electricity distribution service disruptions, resulting in the unfortunate loss of 33 lives in the Dallas and Tarrant counties.[6] That wasn't just a one-off, more than 650,000 customers had their electricity knocked out in the DFW area after severe storms in May 2024.[7]

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4 About | ERCOT

5 Weather-related Power Outages Rising | Climate Central

6 Texas winter storm deaths: 246 total, 22 in Dallas County | wfaa.com

7 Oncor: May storm most damaging in Dallas County's history | wfaa.com

The University purchases all its power and fuel through long term utility contracts to provide energy for heating, cooling, lighting, and electricity demands across the campus. This means it is as exposed to energy-related events just as any other customer of the Texas grid. As much as 75% of UTA's total GHG emissions come only from utility energy consumption.[8]

With utility costs soaring due to large-scale grid infrastructure upgrades, reducing energy consumption and associated emissions while maintaining energy security is imperative for the safety of its community.

What have we learned?

UTA should plan to:

- Reduce energy consumption at buildings through Energy Cost Reduction Measures (ECRM's)
- Implement energy metering and monitoring to enlist all campus buildings in Demand Response programs by the grid operator or distributor
- Upgrade utility feeder and power distribution line weatherization as applicable
- Increase on-site energy generation through clean and renewable energy sources
- Secure redundant power and thermal energy supply for all buildings
- Equip the campus with generators and energy storage systems for backup and emergency power and thermal energy demand at critical campus buildings including student residences

8 UTA FY2023 Greenhouse Gas Emissions Report

UTA's Administration and Facilities Management is implementing an energy conservation program through 18 ECRM's including the following:

- a new 4,000-ton satellite chilled water plant
- transformer upgrades
- lighting retrofits
- occupancy sensors
- air handling unit replacement
- high efficiency motor upgrades
- HVAC improvements

Click here to see the list of projects

Weathering Extremes

As global average temperatures increase, this will result in summer seasons in Arlington extending longer, and winters becoming shorter and less frigid. Moreover, weather patterns are also becoming more erratic resulting in more extreme weather events as witnessed during The Great Texas Freeze in 2021.

Combining extreme weather events with an increase in average temperatures can push the operations of the Central Utility Plant and power distribution systems to peak conditions more often and for longer periods of time. North Texas is no stranger to snowstorms and incessant rain; and in Arlington, these events have led to grid blackouts and flooding across campus and at creeks in surrounding areas.

Heat stress in the summers is typically avoided since most classes are adjourned during periods of peak summer heat. However this can change as peak hot days also occur during the shoulder seasons of Spring and Fall. Prolonged periods without rain will also lead to drought where soil becomes dry and hard, making it difficult for soil to absorb water when it eventually rains. An extreme rainfall event after a serious drought can overwhelm natural drainage and lead to increased runoff and larger volumes of stormwater to be dealt with.

Planning for future weather extremes is essential to ensure safety and operational resilience for the UTA community and its neighbors. Recent weather extremes across the state of Texas and in the DFW area have highlighted the need for this plan. A "resilience-based" approach to the proactive planning of social, environmental, ecological, and infrastructure systems on campus will help it withstand the test of time and mitigate the increasing impacts of weather extremes while also reducing financial burdens in the future.

Source: NOAA CMRA | Higher Emissions Scenario

Historical

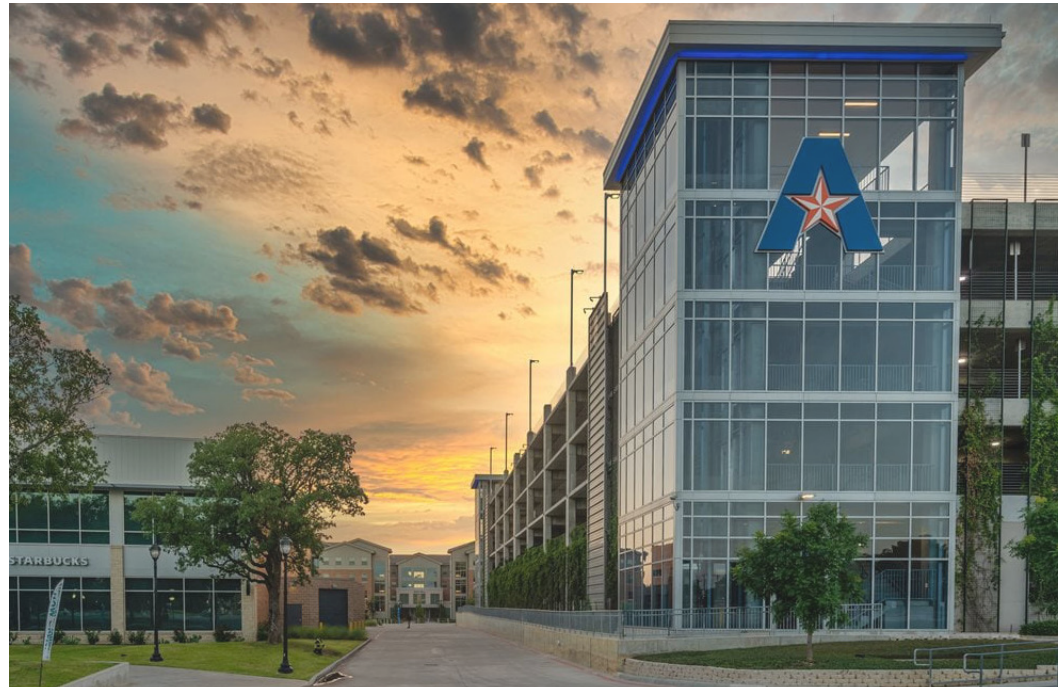
33.9 IN
AVERAGE
(1976-2005)

97.2 DAYS
OVER 90F
(1976-2005)

Projected

33.5 IN
AVERAGE
(BY MID-CENTURY)

135.9 DAYS
OVER 90F
(BY MID-CENTURY)



Source: Left | The Shorthorn . Top Right | UTA . Bottom Right | Dallas News

The Great Texas Freeze

In February 2021, Winter Storm Uri delivered the coldest temperatures North Texas had experienced in 30 years, exposing critical vulnerabilities in UTA's infrastructure systems. During the week-long campus closure, cascading failures affected every aspect of operations - from the central steam plant struggling to heat 31 buildings to widespread water system failures and power disruptions that forced approximately 100 students to seek emergency shelter in campus facilities.

This unprecedented event became a catalyst for transforming UTA's approach to infrastructure resilience. The University responded with immediate improvements: installing new backup generators at critical facilities, developing a dedicated water well for campus heating and cooling systems, and establishing new protocols for protecting vulnerable systems during extreme weather. More significantly, the experience fundamentally changed how UTA approaches infrastructure planning, shifting weather resilience from an emergency response consideration to a central factor in design and operations.[9]

The lessons learned from this historic event directly inform the strategies and priorities outlined in this plan, ensuring UTA is better prepared for whatever challenges the future may bring.

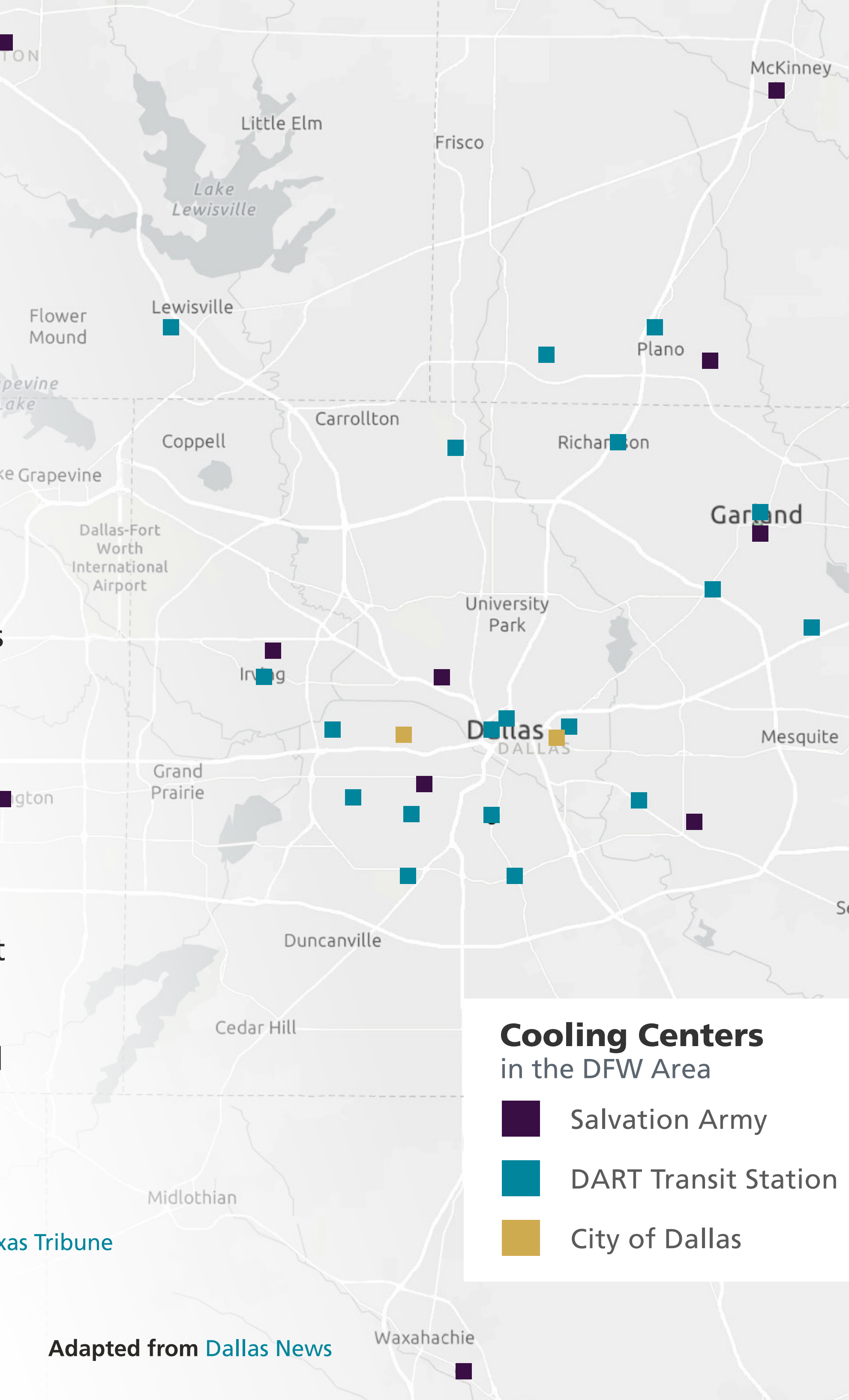
Source: The Shorthorn

9 Storm Recovery | City of Arlington

Managing Heat Stress

Heat stress is a significant health concern in North Texas and the rest of the state due to temperatures frequently exceeding 100°F in the summers that can lead to various heat-related illnesses. Heat stress can be fatal especially for vulnerable populations if not addressed promptly. In 2023, 334 people died from heat-related causes in Texas according to state published data - more than double the number recorded in 2011, which was the record high until 2021.[10] The frequency of these heatwave events is expected to increase due to climate change. Moreover, if high temperatures coincide with days of high humidity this can be very demanding on the cooling systems.

Impacts from extreme heat are especially exacerbated in urban areas. Dense urban areas have a high concentration of buildings, roads, and impervious surfaces, which absorb and retain heat leading to a phenomenon known as urban heat island (UHI) effect. On campus, the UHI effect can lead to temperatures being several degrees higher in denser parts of the campus. With high heat days, exponential increase of energy demand for cooling results in pushing grid operators to implement rolling blackouts and power outages further worsening the heat impacts.



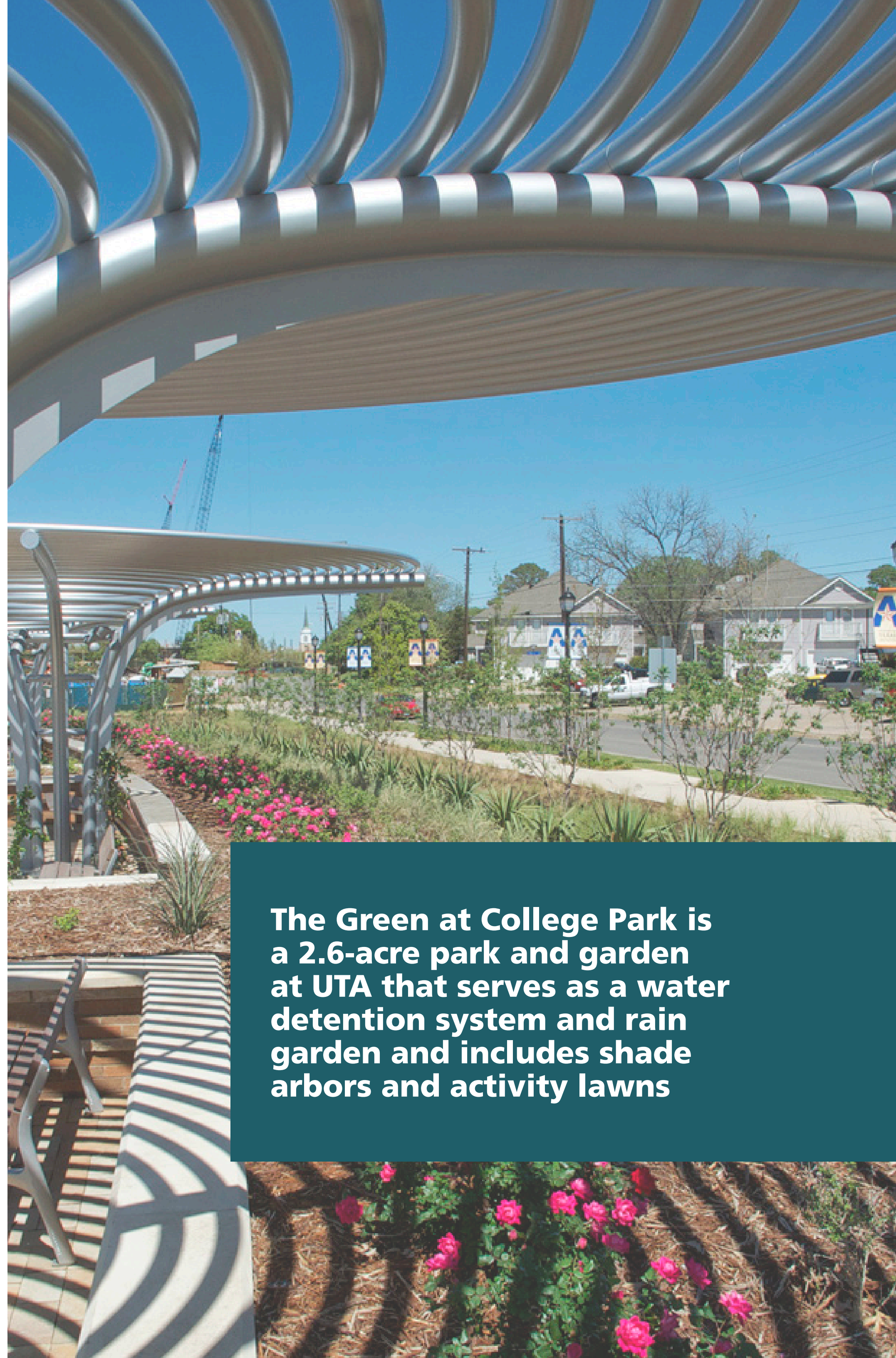
Adapted from Dallas News

10 Texas saw a record number of heat-related deaths in 2023 | The Texas Tribune

Dry Spells to Downpours

As recently as 2024, the DFW area went 34 consecutive days without any precipitation, its eighth longest without rain per the National Weather Service. These events have also become more frequent and longer-lasting over the past five years.[11]

Extended drought conditions can cause stormwater infrastructure to accumulate dirt and debris which are not washed away by regular rainfall. Moreover, droughts also impact the natural ability of soils to absorb water. This buildup in pipes and drains, and the soil's loss of infiltration, can lead to more damaging impacts from stormwater runoff due to reduced natural and infrastructure systems capacity. If we follow the region's typical climate pattern, these drought conditions are followed by precipitation. These first rains can wash accumulated particles that are harmful to the local ecosystems into nearby water bodies further impacting the wider Johnson Creek watershed.



The Green at College Park is a 2.6-acre park and garden at UTA that serves as a water detention system and rain garden and includes shade arbors and activity lawns

Source: UTA Magazine

11 DFW - Consecutive Days Without Precipitation | NOAA - NWS

What have we learned?

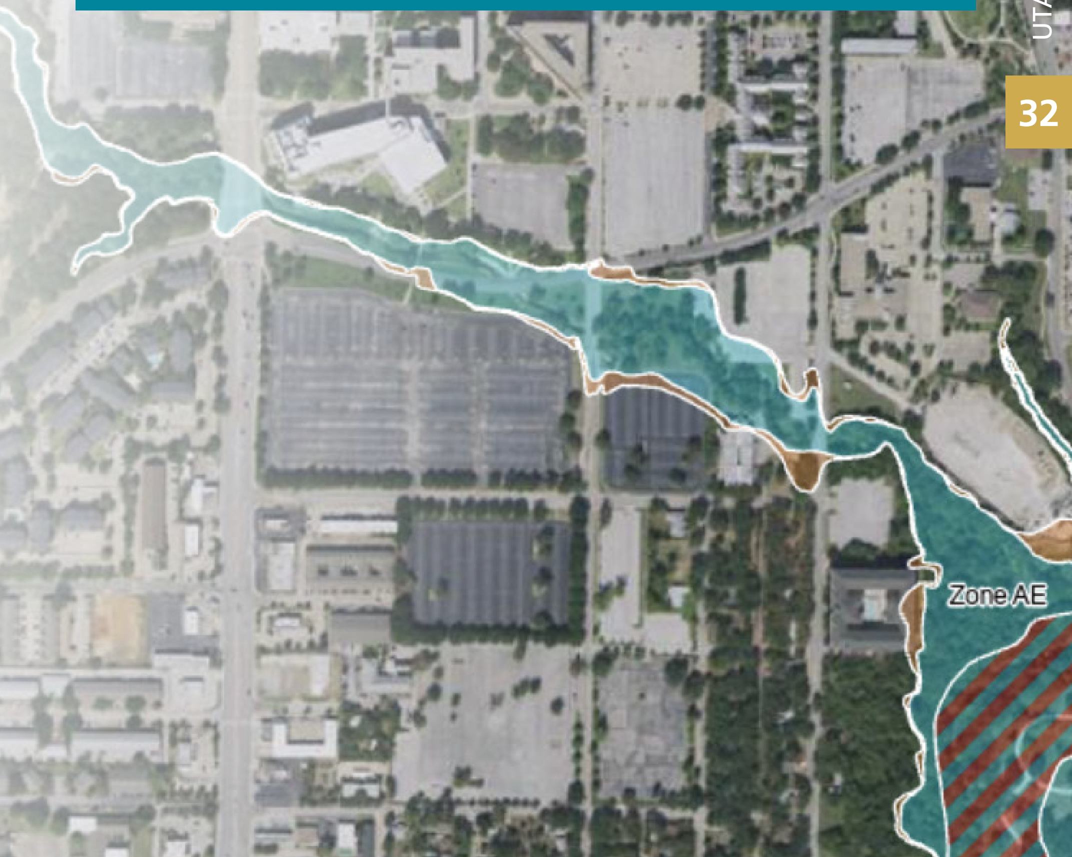
To ensure a resilient future, UTA should implement:

- Active and pre-emptive emergency communication networks and systems
- Redundant power and thermal energy supplies
- Energy storage for backup and emergency power and thermal energy demand at critical campus buildings including student residences
- Campus utility systems weatherization (where applicable)
- Regular maintenance and strict adherence to prescribed standards for management of campus stormwater infrastructure
- Increase percentage of green cover across campus
- Increase stormwater flow capacity and detention of creek to prevent flooding of campus areas
- On-site stormwater management including managing stormwater flows to building rain barrels and underground collection tanks
- Strict pre- and post-construction waste management standards to reduce pollutants entering runoff to local watershed

Did you know?

The Johnson Creek tributary which passes the SEIR building on UTA's campus drains into the Johnson Creek watershed, the second largest in Arlington. In 2022, Johnson Creek was listed on the TCEQ 303(d) list with an impairment for bacteria in the water.

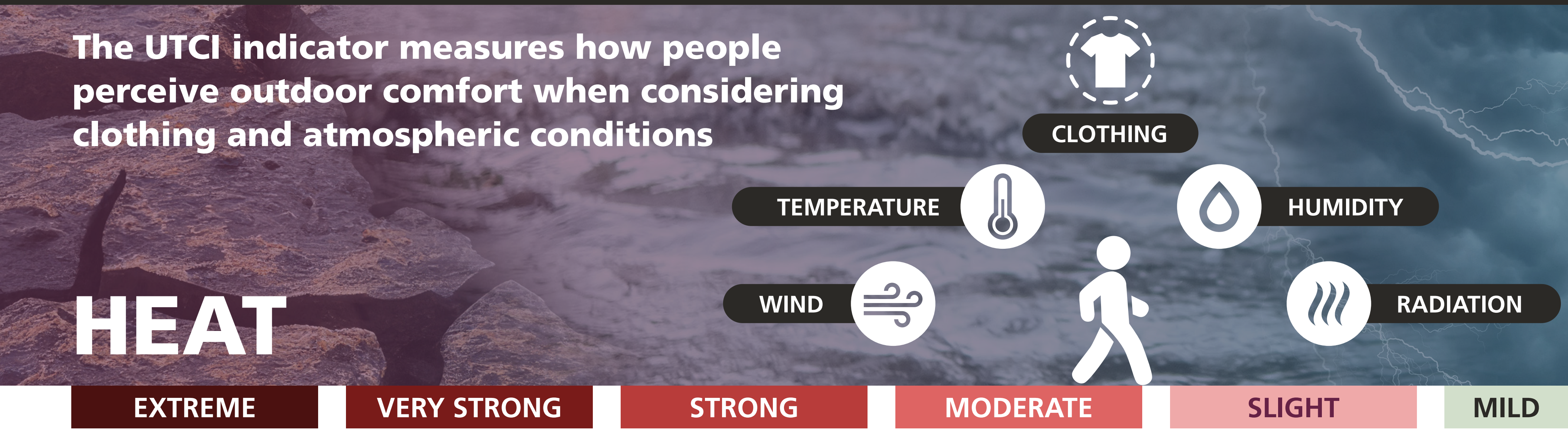
Source: City of Arlington Environmental Management



Campus Comfort Analysis

To understand heat stress conditions throughout the year, a Universal Thermal Climate Index (UTCI) study was completed. The UTCI is an internationally recognized standard that evaluates how the human body responds to outdoor conditions. This comprehensive metric proves particularly valuable in Texas, where the combination of intense solar radiation, high humidity, and variable winds creates complex comfort challenges throughout the academic year.

33 Universal Thermal Climate Index



Outdoor Thermal Comfort

% of Hours Comfortable from March to May

Percentage of Hours Comfortable

0 — 100

UTA Spring Comfort Time

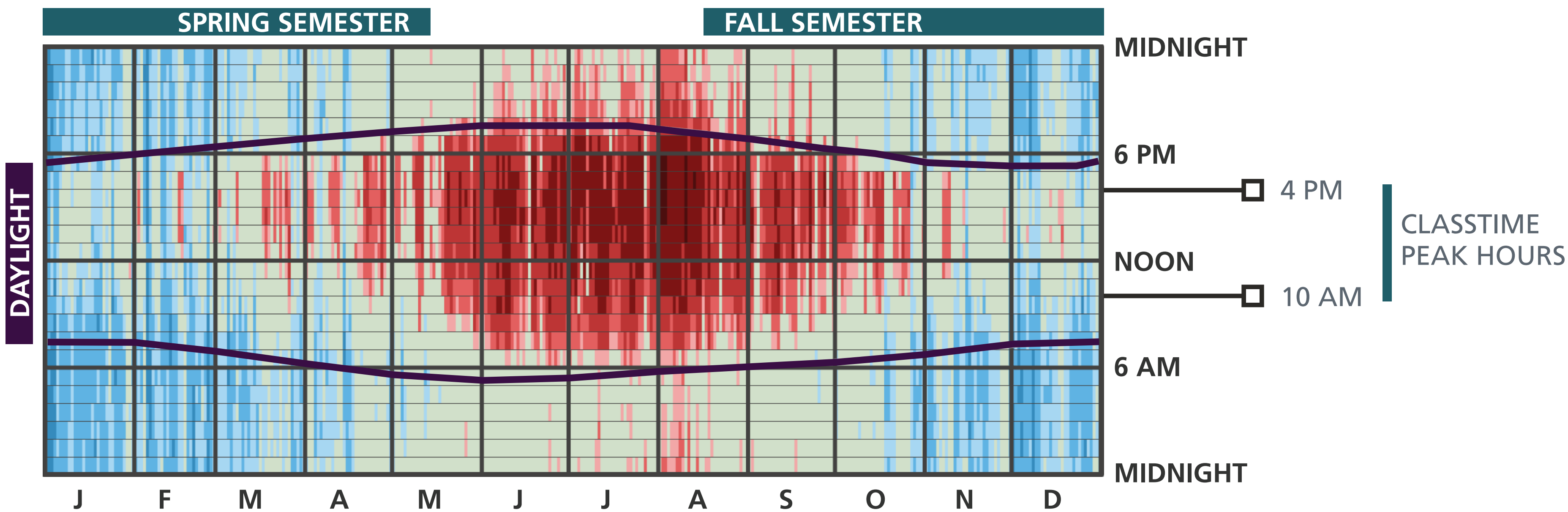
46.36%

COLD

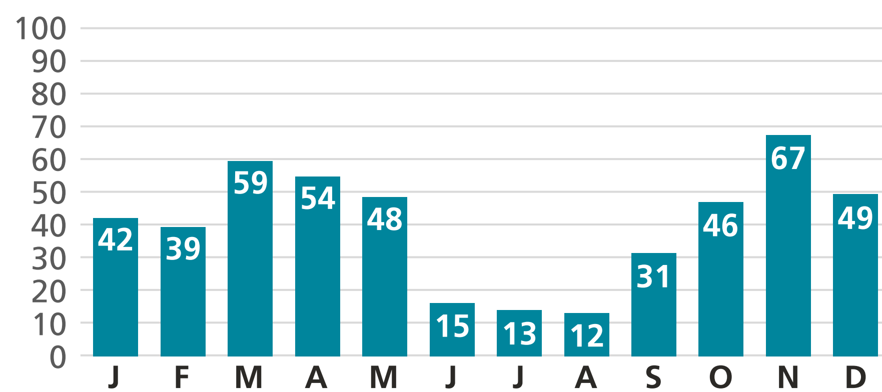
MILD | SLIGHT | MODERATE | STRONG | VERY | EXTREME

The UTA campus, situated in the heart of Arlington, experiences the full range of North Texas weather patterns. The most challenging periods occur between May and October, which notably overlap with both the end of spring semester and the beginning of fall semester - important times in the academic calendar. During these months, outdoor spaces experience sustained heat stress during peak class hours, with conditions often exceeding comfortable thresholds between late morning and early evening. This timing particularly impacts students moving between classes or studying in outdoor spaces. While early morning and evening hours provide some relief, the extended Texas summer means that uncomfortable conditions can persist well into the fall semester.

24-Hour Thermal Comfort Patterns



Outdoor Thermal Comfort
Percentage of comfortable daytime hours



As shown in the spring comfort analysis, well-designed spaces incorporating shade and proper air movement can double the number of comfortable hours - from approximately 35% to 75% during March through May. This dramatic improvement over unprotected areas demonstrates the potential impact of strategic design interventions. The difference becomes even more pronounced during summer months, when shaded areas can provide critical relief during peak heat periods.

Building arrangement and landscape design significantly influence these patterns. Areas with mature tree canopy show markedly better performance, maintaining usable conditions even during challenging spring and fall seasons. Similarly, spaces that benefit from building shade while allowing adequate air movement demonstrate notably higher comfort ratings. However, some building configurations create problematic conditions - either blocking beneficial breezes or creating uncomfortable wind tunnel effects.

The comfort analysis highlights priority areas for intervention, particularly along major pedestrian routes where exposure to extreme conditions is unavoidable. High-traffic paths between academic buildings, popular gathering spaces, and transition zones between indoor and outdoor environments require attention for maintaining usable conditions as temperatures continue to rise.

Managing Sun and Shade

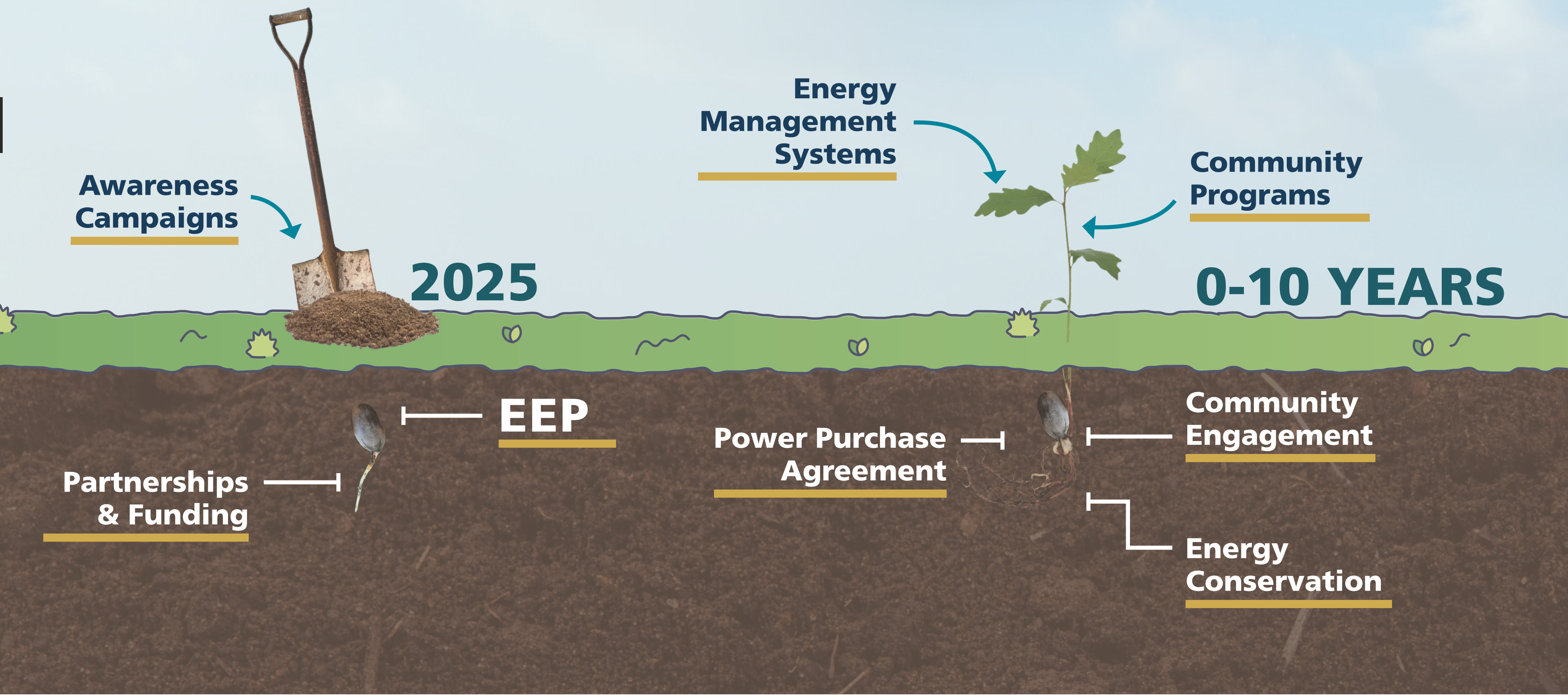
In Texas, shade becomes a key resource for extending the usability of outdoor spaces. The analysis shows that strategic shade placement can dramatically improve summer comfort conditions, proving especially pertinent given UTA's role as a largely pedestrian campus where students often need to walk significant distances between classes. Targeted shade deployment could significantly improve the campus experience during the hottest months while having minimal impact during Texas' typically mild winters.

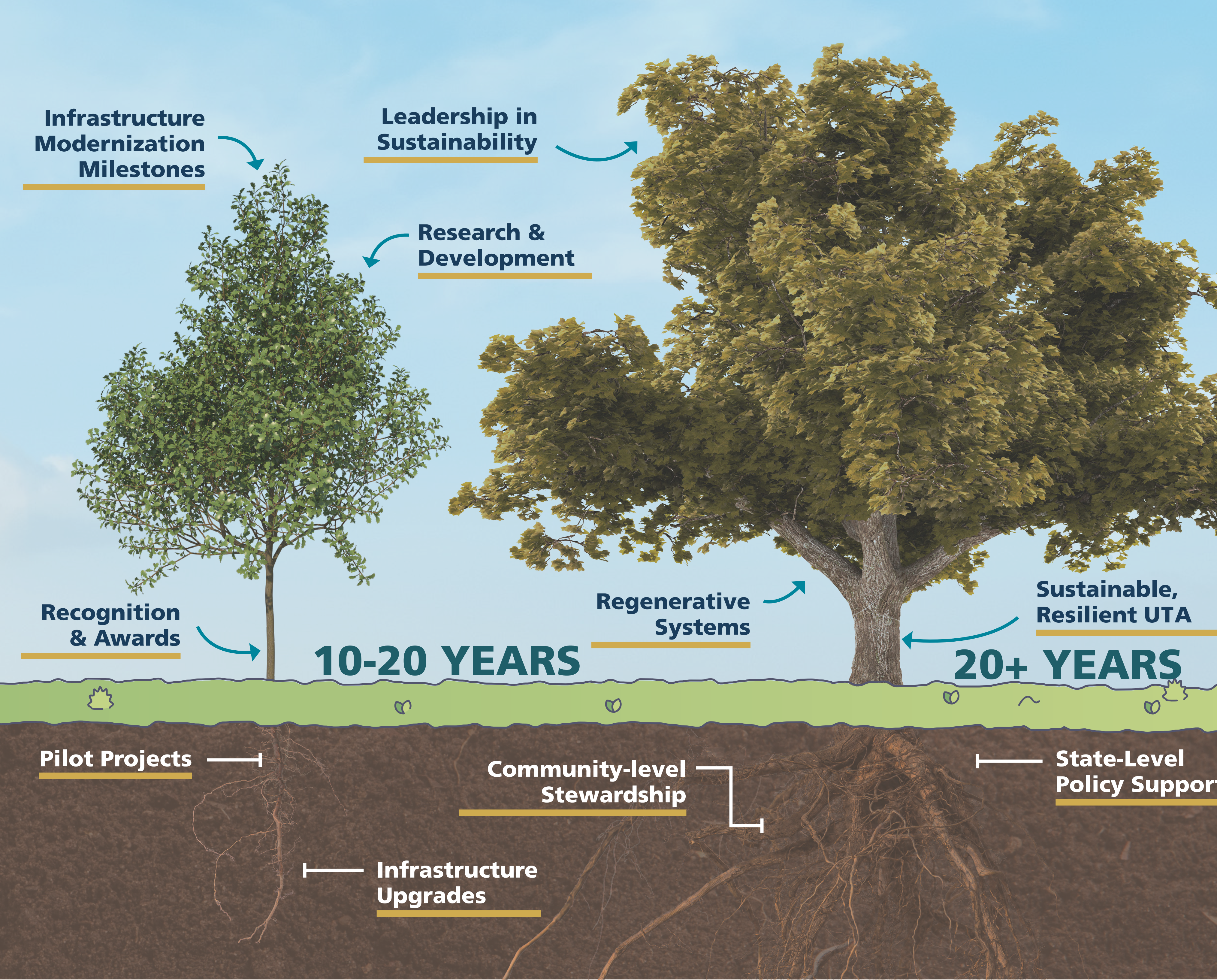
Wind Patterns and Natural Ventilation

Arlington's location in the southern Great Plains, combined with its position relative to the Trinity River basin, shapes its characteristic wind patterns. These regional features create predominant southerly winds averaging 9.1 mph, with stronger winds common throughout the year. This natural ventilation can help improve comfort during warmer months, but only when building arrangements and landscape features work with these patterns rather than against them. The campus analysis reveals areas where building configurations either block these beneficial southern breezes or create uncomfortable wind tunnel effects, suggesting opportunities for strategic interventions that better manage air movement across campus spaces.

Stabilizing our foundation

The Energy Efficiency Plan plants a seed of new opportunity, helping UTA's established roots become stronger through beneficial policies and strategies that assist the University's growth over the next 20 years and into the future.




Infrastructure Modernization Milestones
Leadership in Sustainability
Research & Development
Recognition & Awards
Regenerative Systems
Sustainable, Resilient UTA
10-20 YEARS
20+ YEARS
Pilot Projects
Community-level Stewardship
State-Level Policy Support
Infrastructure Upgrades