Overview of Equity Incorporation in Climate READi

Summary of Texas Case Study Process and Findings

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Equity in Climate READi

The vulnerability identification methodology and example applications of this identification for resilient system planning summarized below seek to address the following question:

Once a climate hazard has created an outage situation, who is the most vulnerable?

Two stages of this approach:

Stage 1:

Identifying Vulnerable Communities

Stage 2:

Applying Vulnerability Designations to Workstream 3 Analysis

Stage 1.1: Survey Existing Public EJ and Equity Metrics

What data is already out there? What can it tell us? What's missing?

- Downloaded underlying data for the following tools:

EPA EJScreen

Climate and Economic Justice Screening Tool

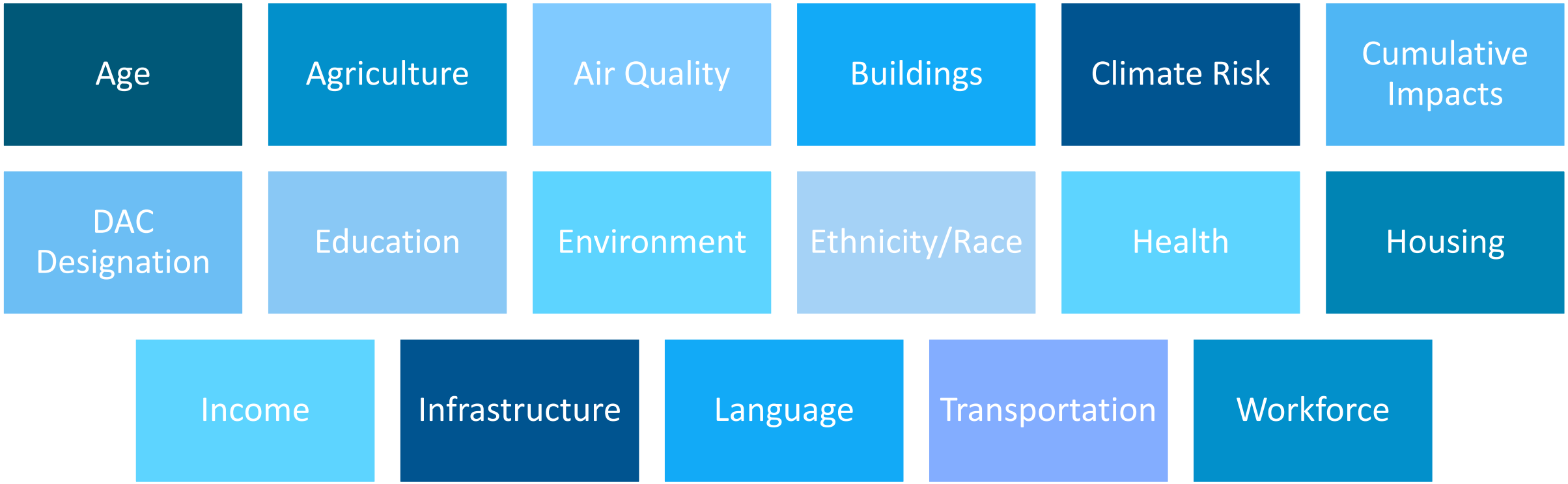
CDC/ATSDR Social Vulnerability Index

CDC ATSDR Environmental Justice Index

- Collated, categorized, and sorted all existing metrics: over 500 distinct metrics across the tools

Stage 1.2: Categorizing Data and Metrics

- 557 discrete metrics across the 4 tools surveyed
- Assigned each one into the following buckets:



Stage 1.3: Parsing Through the Data

- Many of the metrics represented across the tools were functionally the same, for example:
  - Very similar metrics with a few specification differences
    - Poverty line threshold
  - Helpful, but didn't have a lot of data coverage
    - Historical Underinvestment
  - Measuring essentially the same thing
    - Raw income data vs. comparative indices
- Some metrics were unique to their respective tool
    - Health metrics only reported in CDC tools

Large list of metrics was consolidated to streamline the process, avoid redundancy and repetition

Stage 1.4: Selecting Final Indicators

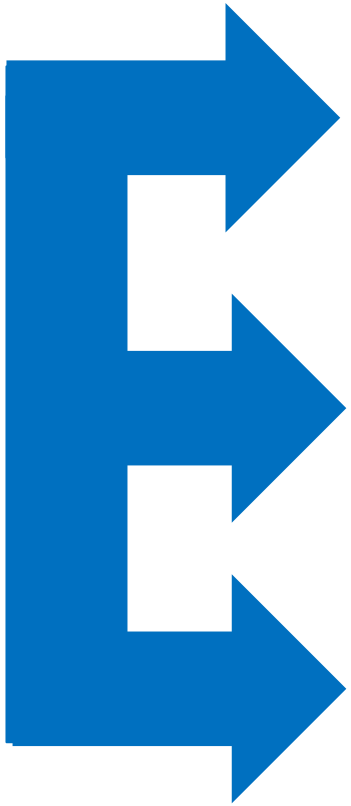
Indicator	Category	Source
Median household income as a percent of area median income	Income	CEJ Screening Tool
Percent of the population over 65	Demographic	EJ Screen
Percent of the population under 5		CEJ Screening Tool
Asthma among adults	Health	EJ Screen
PM 2.5 concentration		CDC SVI
Non-institutionalized population with a disability		CDC SVI
Number of shelters in each tract	Housing/Transportation	National Shelter System Facilities
Linguistic isolation		CEJ Screening Tool
Houses Built before 1960		CEJ Screening Tool
Mobile homes estimate		CDC SVI
Percentage of households with no vehicle		CDC SVI

1. Climate and Economic Justice Screening Tool
2. EPA's EJScreen
3. CDC Social Vulnerability Index

Stage 1.5: Identifying Vulnerable Census Tracts

Final index of equity metrics pulled from different sources, expressed in different units, and at different scales

- Needed to make choices about how to bring all of this data together in a useable format



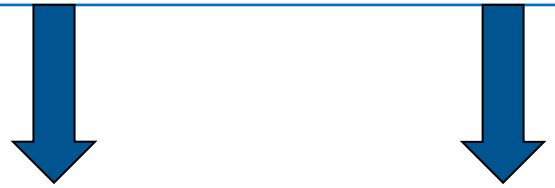
Absolute data/percentages/nationwide percentiles

Texas-specific percentile thresholds at 50th, 75th, and 90th percentiles for **each individual metric**

A census tracts meets our criteria if it a) meets the low-income condition, and b) is above the threshold for at least two other metrics

Stage 1.6: Descriptive Statistics

	Census Tracts	Population
Total	5,265	30,029,572
Vulnerable	873	3,551,974



16.6%

of all census tracts in Texas meet our criteria for disadvantaged

11.8%

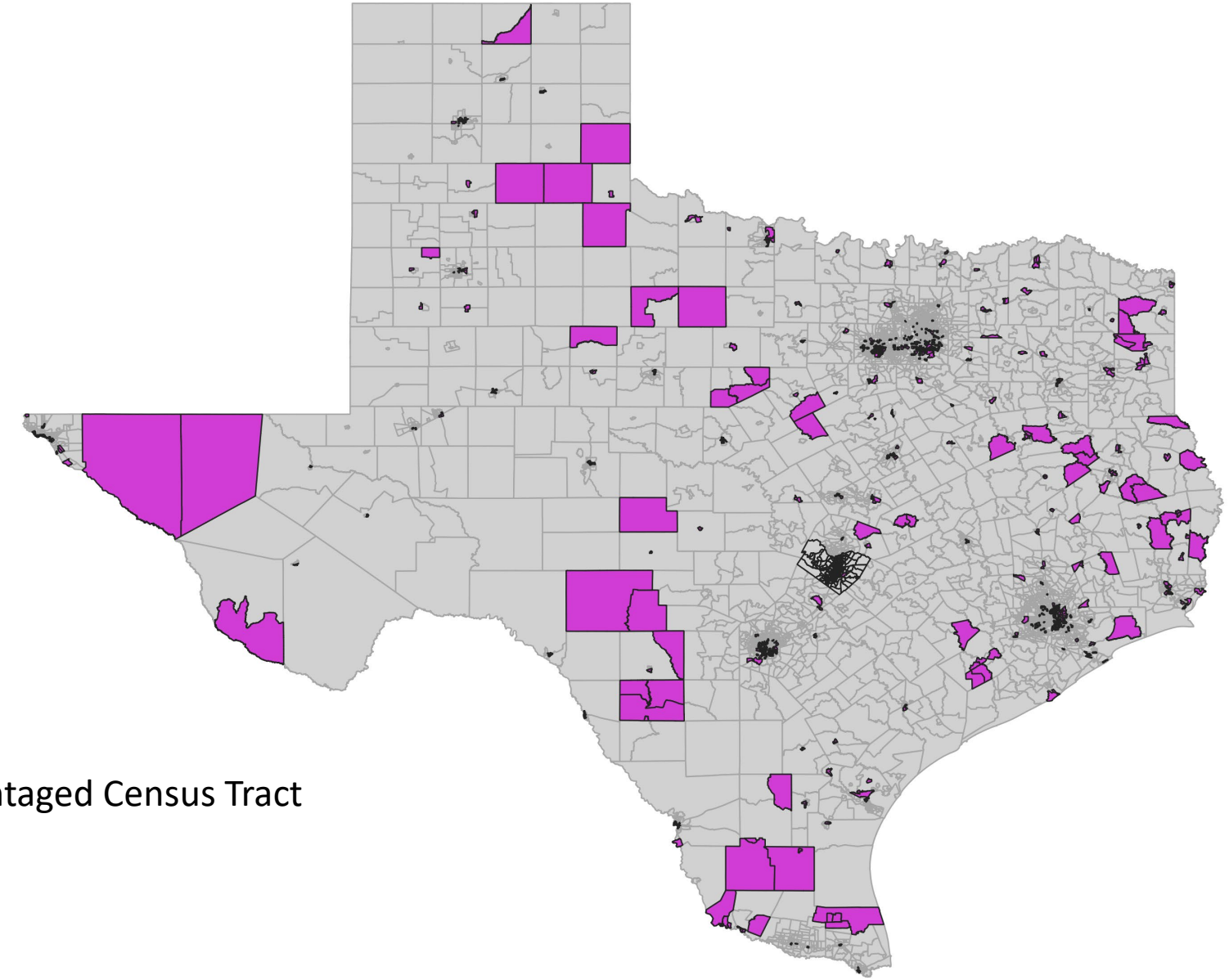
of the total population of Texas live in our identified vulnerable census tracts

Of the 873 vulnerable census tracts, 721 not only meet the baseline threshold, but are actually considered vulnerable across 4 or more of our indicators.

Of the 873 vulnerable tracts, the three most common indicators are:

1. **Adults with asthma**
2. **Population without vehicles**
3. **Linguistic Isolation**

Stage 1.7: Results Visualization



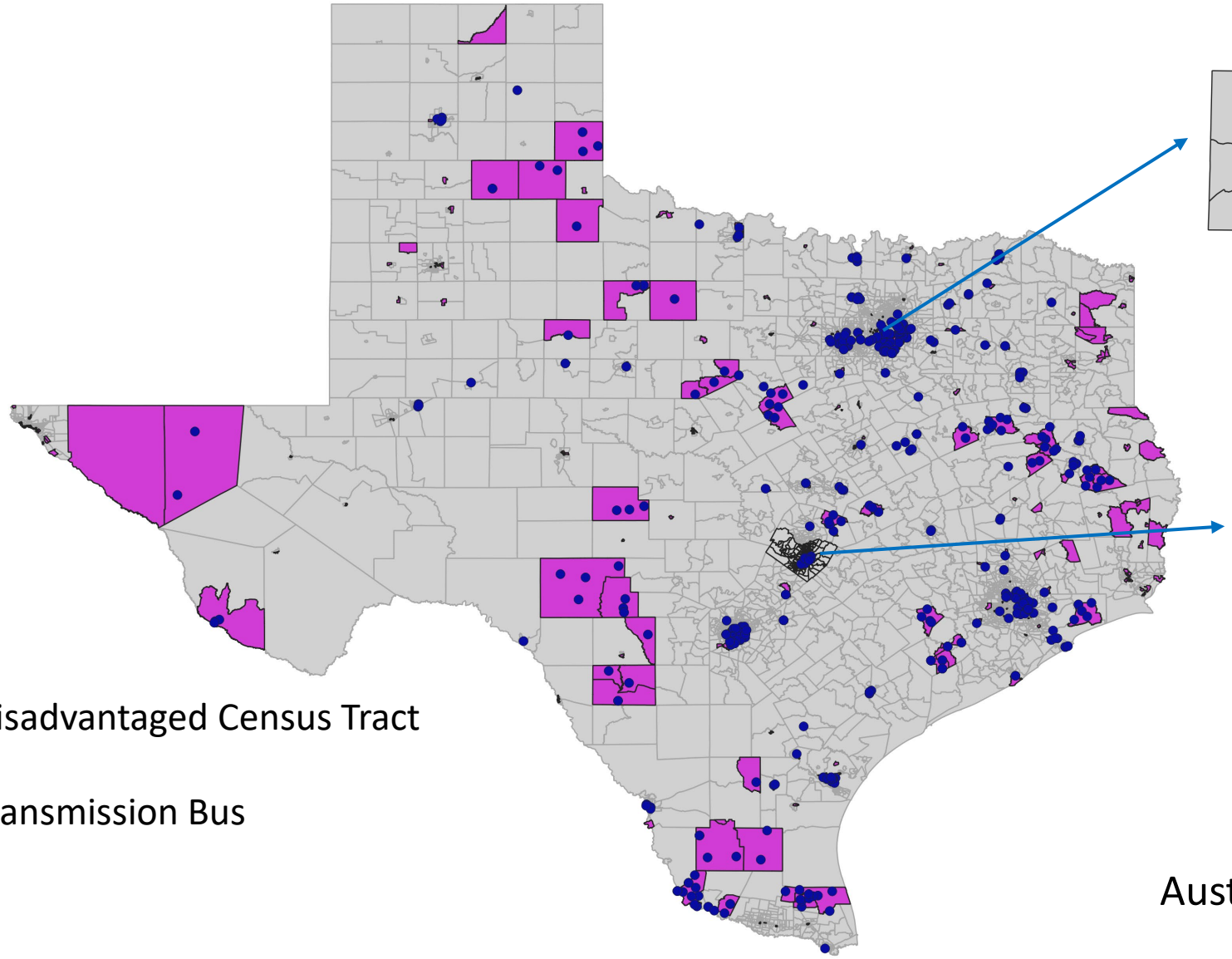
Disadvantaged Census Tract

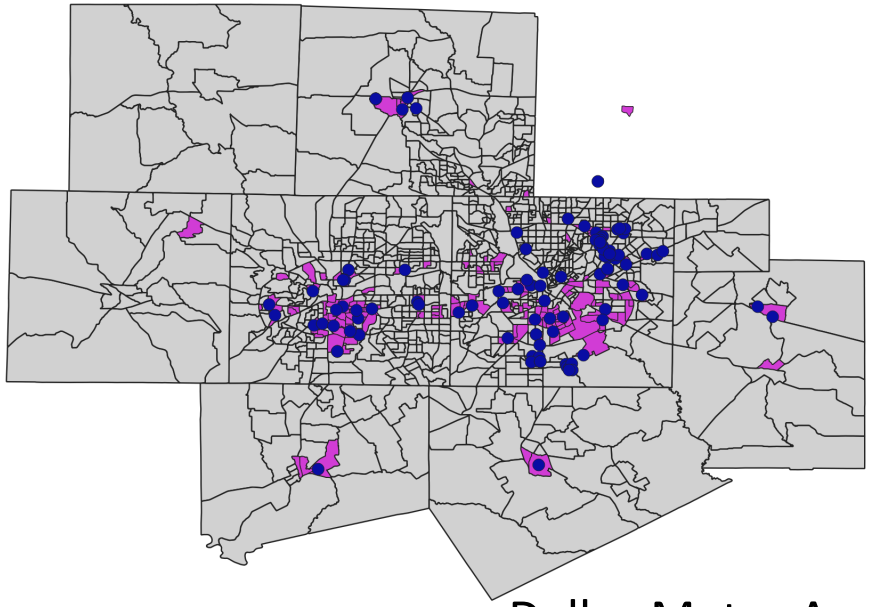
The purple census tracts meet our criteria for vulnerability.

We can get some useful information from this map, but so far, **we have not linked this data to the power system in any way yet.**

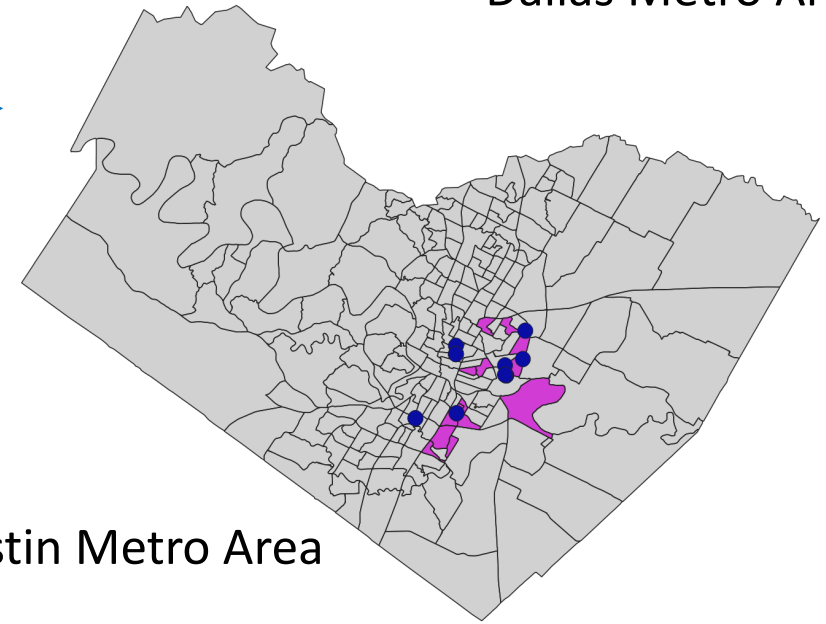
If we want to understand how these census tracts interact with the power system and understand how the disparities summarized in this vulnerable designation relate to climate resilience planning we need to tie these two streams together.

Stage 1.8: Mapping Transmission Infrastructure to Disadvantaged Tracts





Dallas Metro Area



Austin Metro Area

Disadvantaged Census Tract

Transmission Bus

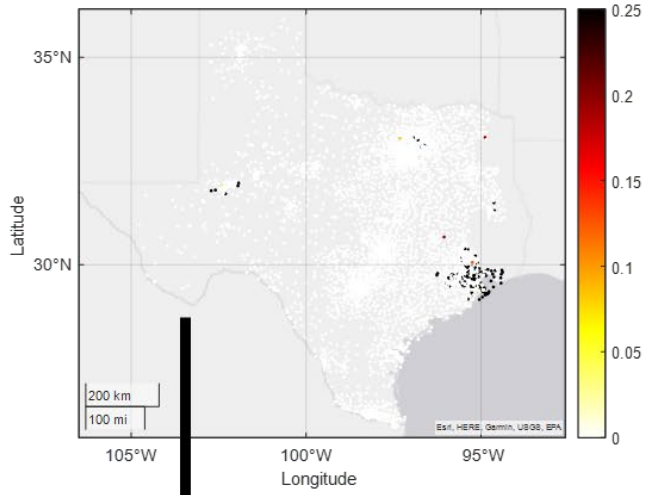
Stage 2: Equity-Informed Modeling Overview and Constraint Formulation

- Adaptive Coordinated Expansion Planning (ACEP) model
  - Nodal capacity expansion model that identifies the least cost expansion plan for a given Lost Load Tolerance (LLT).
    - For example, LLT 10% requires the capacity planning model to build a system that does not shed more than 10% of system demand under any simulated hazard
- Three cases:

Baseline	Targeted Equity	Full Equality
Percentage of aggregate system-wide unmet demand must be less than the given LLT	Unmet demand at individual transmission nodes located in designated vulnerable census tracts was set not to exceed the LLT	Unmet demand at every individual transmission node was set not to exceed the LLT

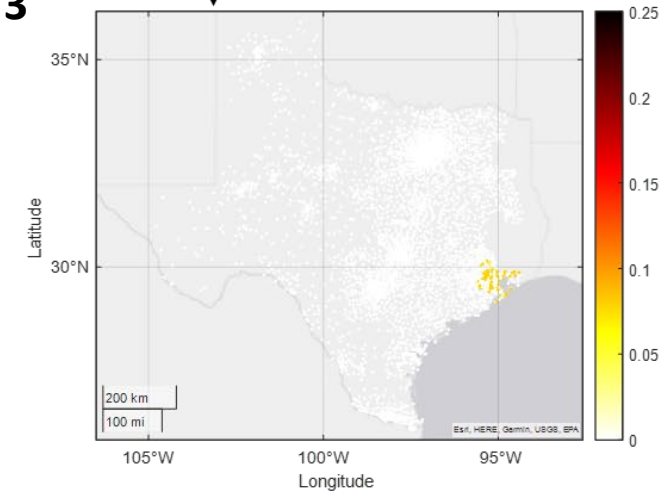
Stage 2 Results: Constraining Unmet Demand

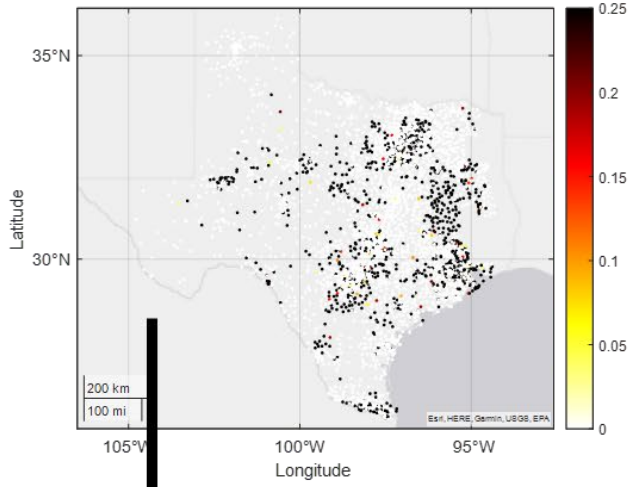
Case 1



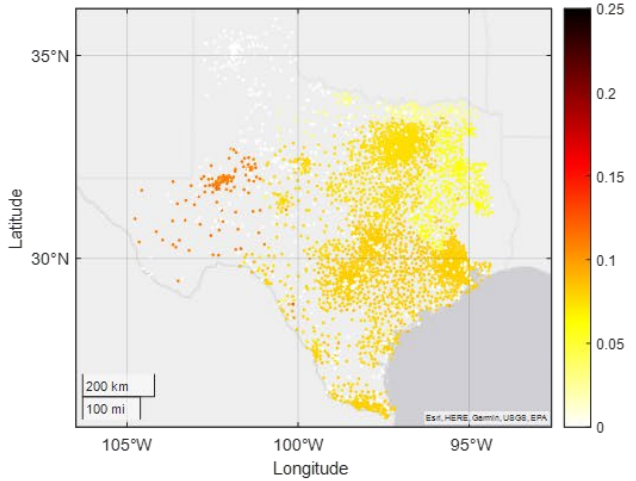
Localized Heat Event

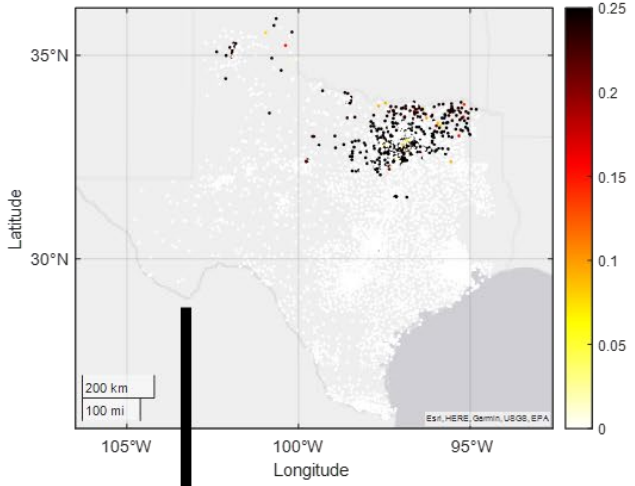
Case 3



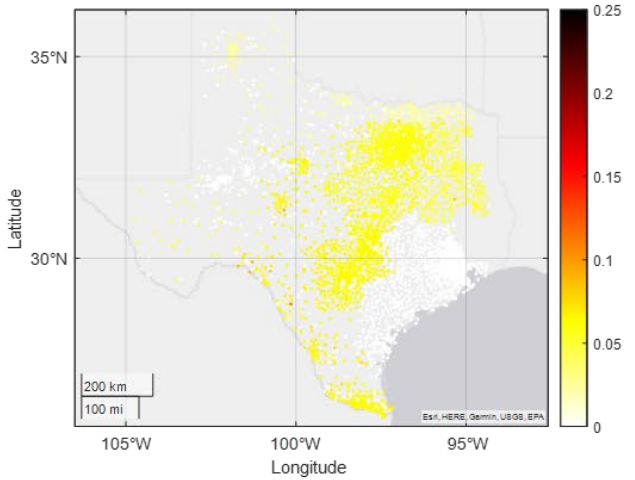


Widespread Heat Event



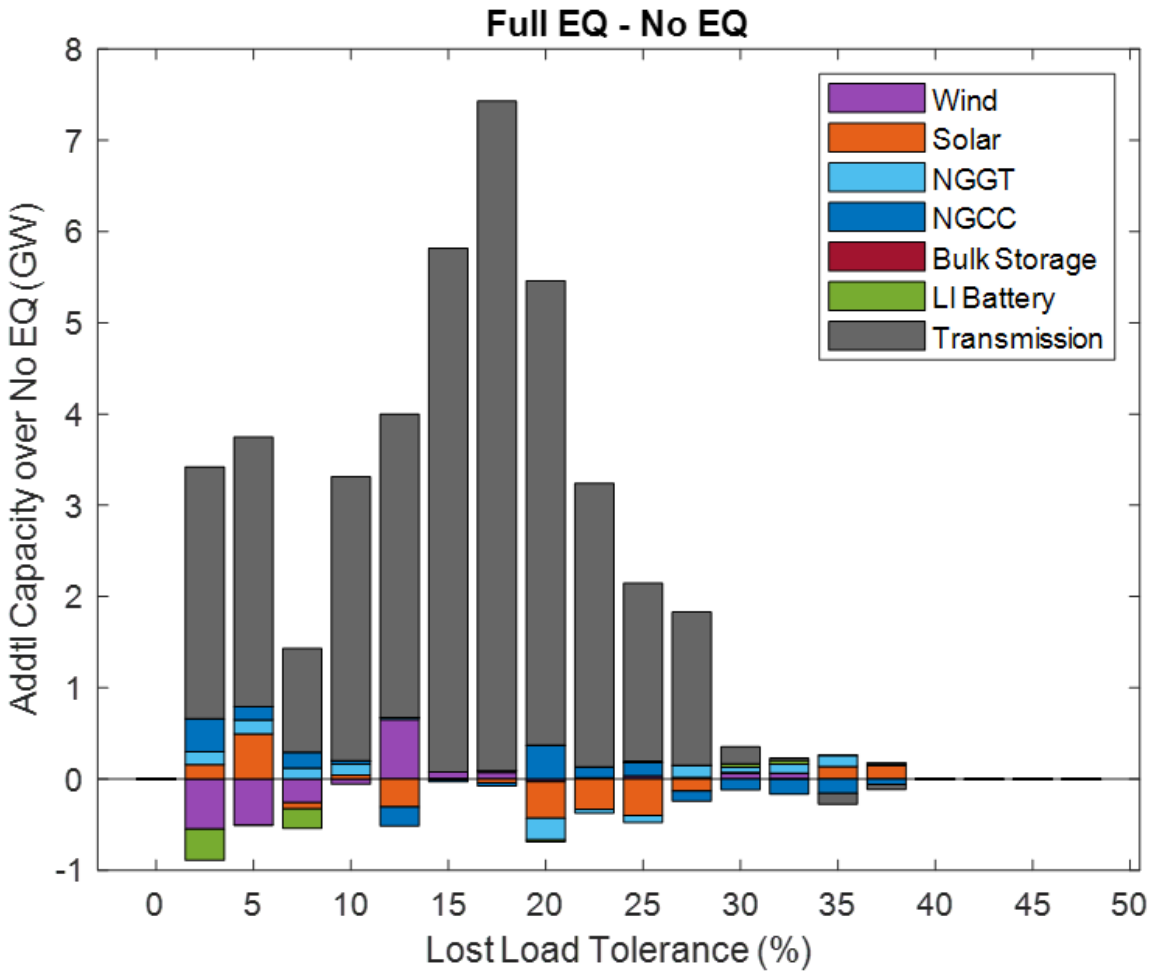


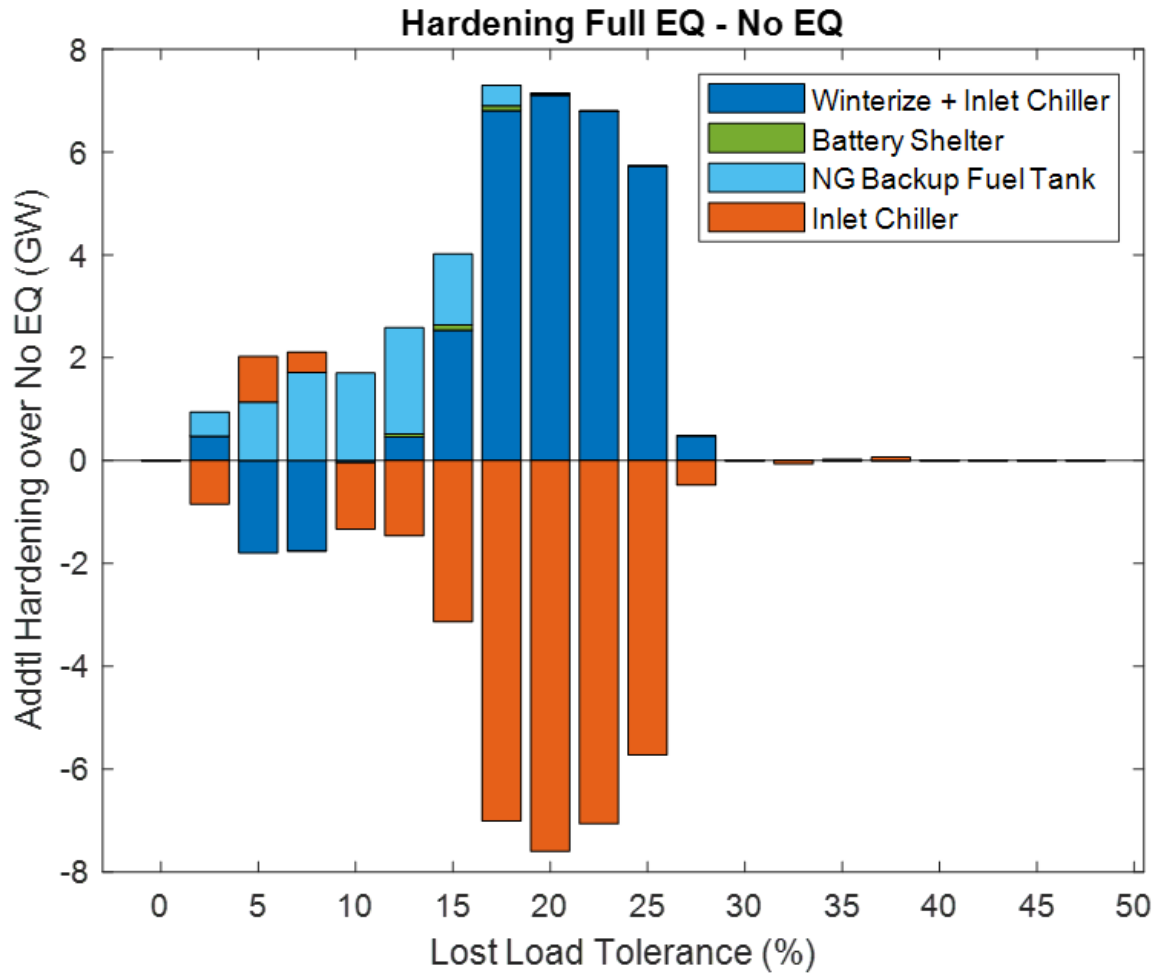
Cold Event



The addition of an equity constraint increases the total number of buses affected and decreases the relative share of unmet demand experienced at each bus.

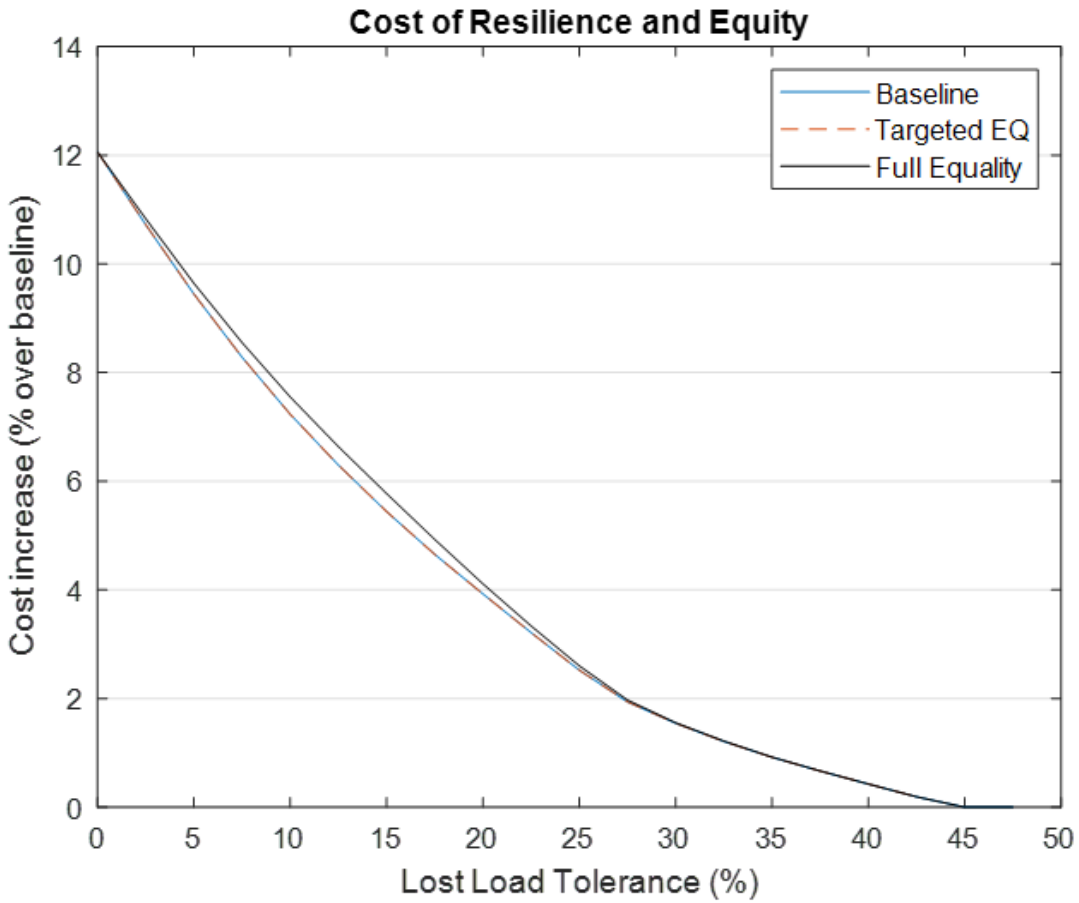
Stage 2 Results: Generation Capacity Expansion

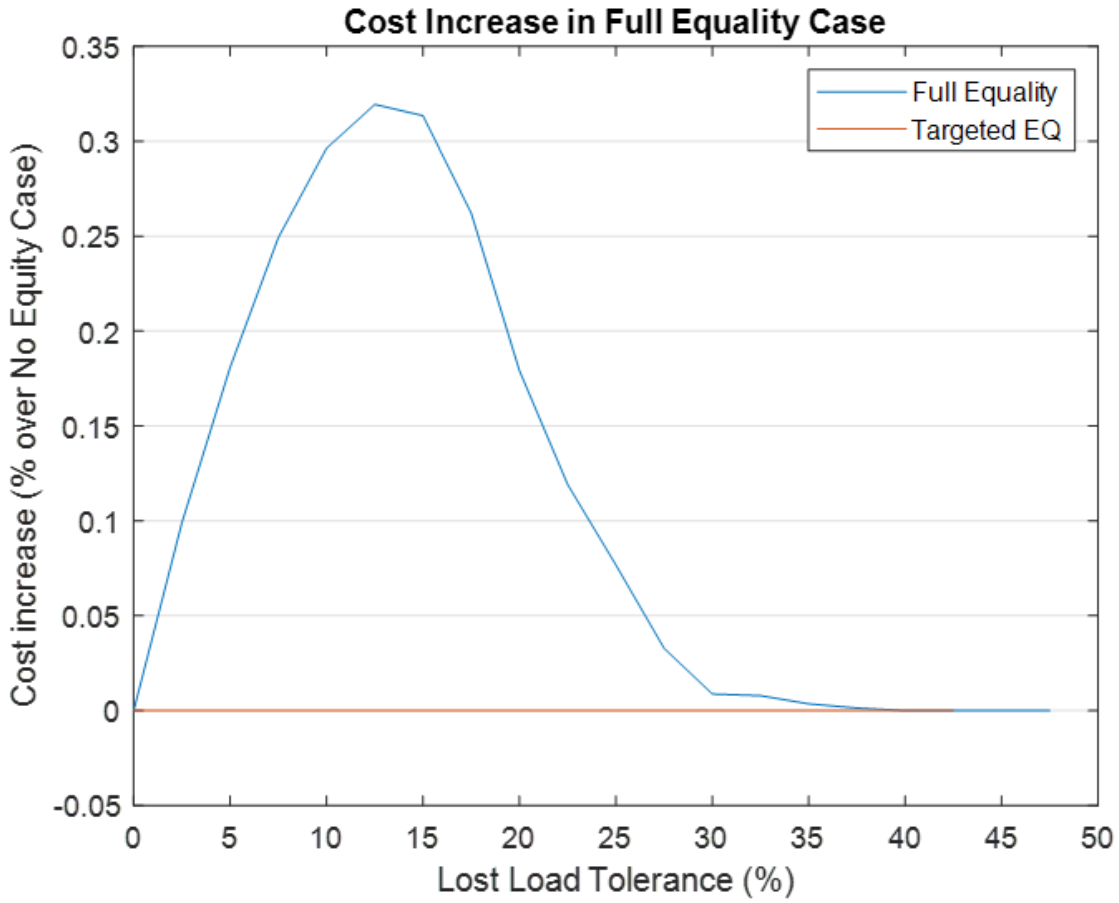




Timing and type of bulk system infrastructure and weatherization/hardening investments change under the full equality scenario, at all LLT levels.

Stage 2 Results: Cost Impacts





Total cost of full equity scenario is .34% higher than the no equity scenario, peaking at 10-15% LLT.

Key Takeaways

- Targeted equality case **functionally the same** as the baseline case
  - Implies that when targeting reduction of outage burden to particular communities, operations choices can have higher importance and impact than planning decisions
- Outage consequences **geographically redistributed**
- Full equality case builds **significantly more transmission**
- Cost impacts **relatively modest**

Other Applications of Vulnerable Community Data in WS3

- Transmission Operations
  - Does not include the vulnerability information as an input to their analysis, the vulnerable designations for each census tract can be applied to the results
  - These considerations can be used to determine the priorities of equipment adaptations.
- Distribution Operations
  - Strategic Load and Energy Disconnection (SLED) tool permits the inclusion of equity considerations in its simulations
  - The vulnerability designations can be used to exclude certain communities from load shedding operations due to the increased proportional costs they may face.
- Distribution Planning
  - Number/proportion of disadvantaged customers served by each feeder used as a parameter in the ranking process, placing higher importance on feeders that serve more vulnerable customers
  - This ranking is then used to determine which feeders should be prioritized for resilience upgrades
- Cost-Benefit Analysis
  - er consequences
  - Health AssessmentEquity data used to modify assumptions for expected outage costs for vulnerable areas
  - Framework assumes that outages on feeders serving vulnerable customers have 50% high
  - Does not explicitly consider the vulnerable identification data but can serve as a useful comparison point

ClimateREADi Equity Methodology

1. Survey existing EJ and Equity in the power system literature, metric, and data synthesis
2. Identify of a core suite of applicable metrics for a particular research question
3. Aggregate selected metrics for analysis of vulnerable geospatial units (i.e., census tracts)
4. Plug into sub-areas of WS 3
    i. Capacity Expansion Modeling

EPA EJScreen

Climate and Economic Justice Screening Tool

CDC/ATSDR Social Vulnerability Index

CDC ATSDR Environmental Justice Index