Resilient Connecticut
Phase II

Climate Change Vulnerability Index (CCVI) Methodology

UCONN
UNIVERSITY OF CONNECTICUT

CONNECTICUT ENERGY ENVIRONMENT

CIRCA
Connecticut Institute for Resilience and Climate Adaptation

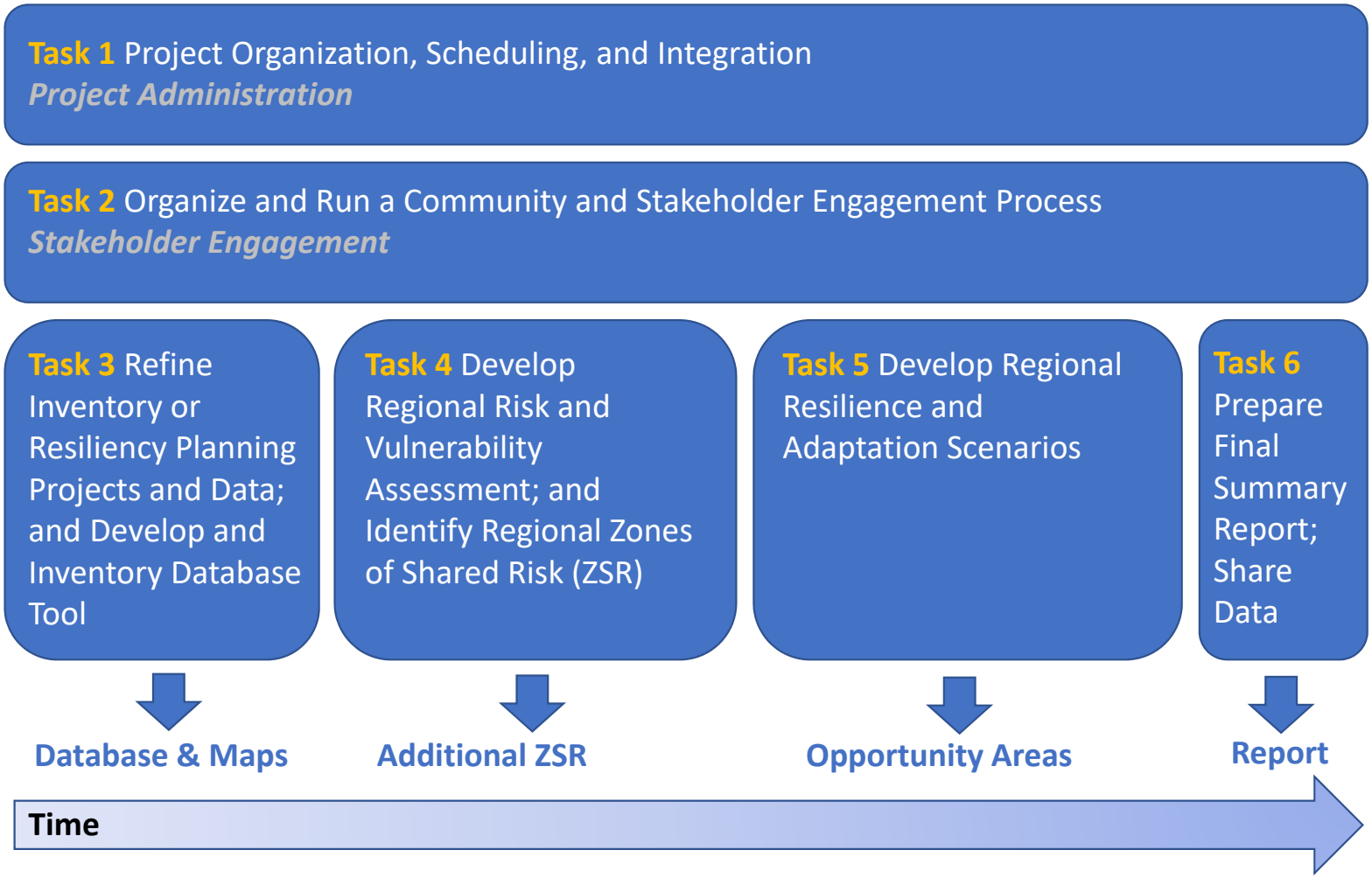
U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

CONNECTICUT
Department of Housing

MILONE & MACBROOM

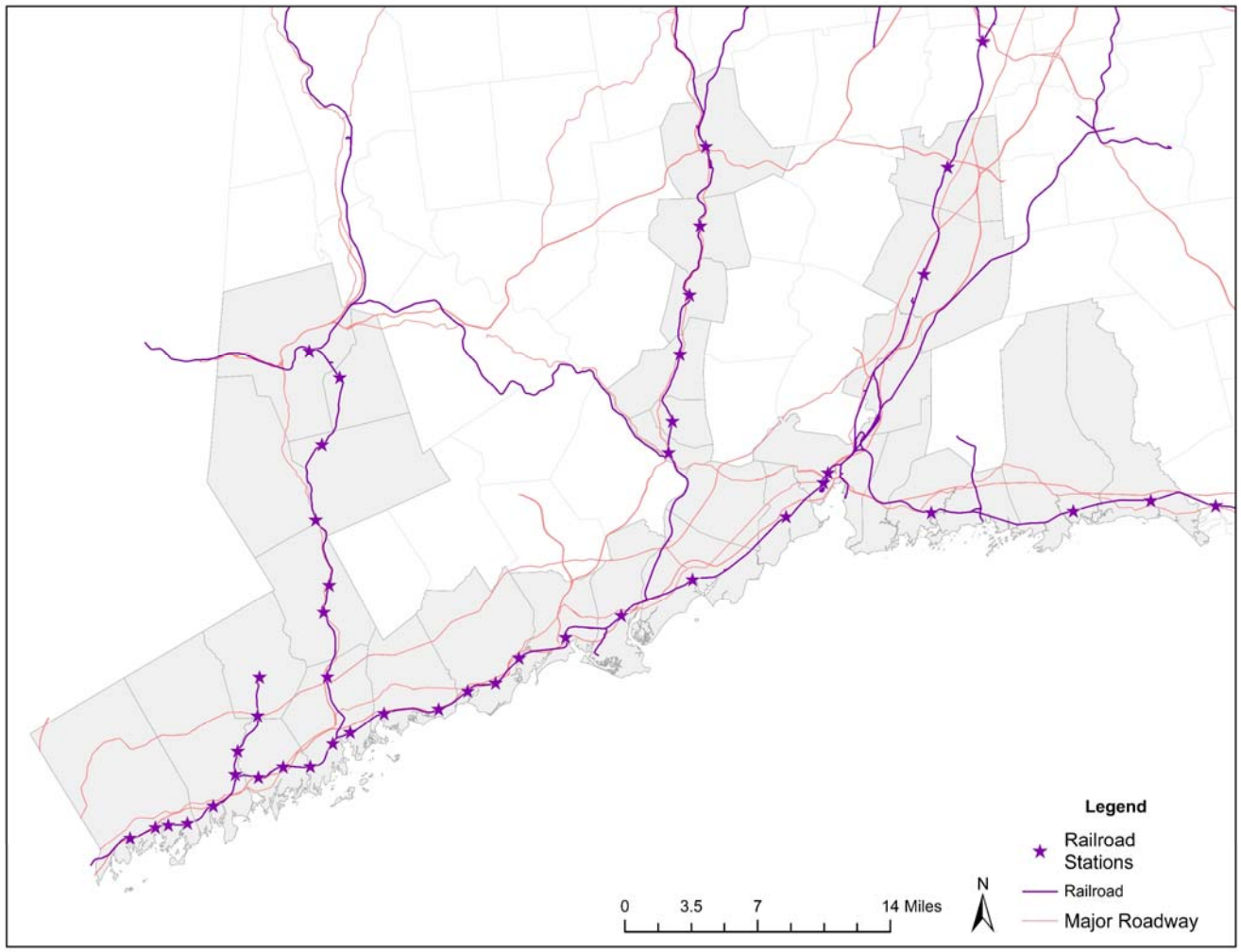
Dewberry

Phase II Scope

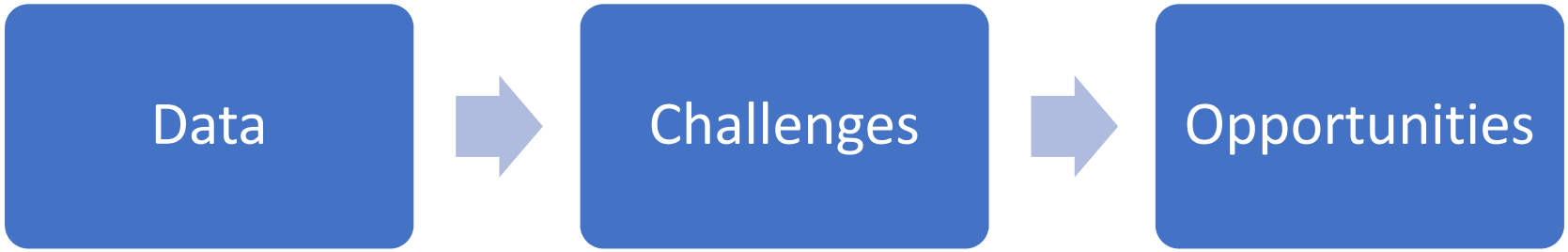


Area of Focus

- Fairfield and New Haven Counties
- Communities with Transit-Oriented Development (TOD) Potential
- Communities with Resilience Corridor Potential



What is the Path to Resilience?



Task 3
Refine the Inventory of Resiliency Planning Projects and Data, and Develop a Database Tool

Compile the Data to Set the Stage

Task 4
Develop a Regional Risk and Vulnerability Assessment and Identify Regional Zones of Shared Risk

Identify the Climate Challenges

Task 5
Develop Regional Resilience and Adaptation Scenarios

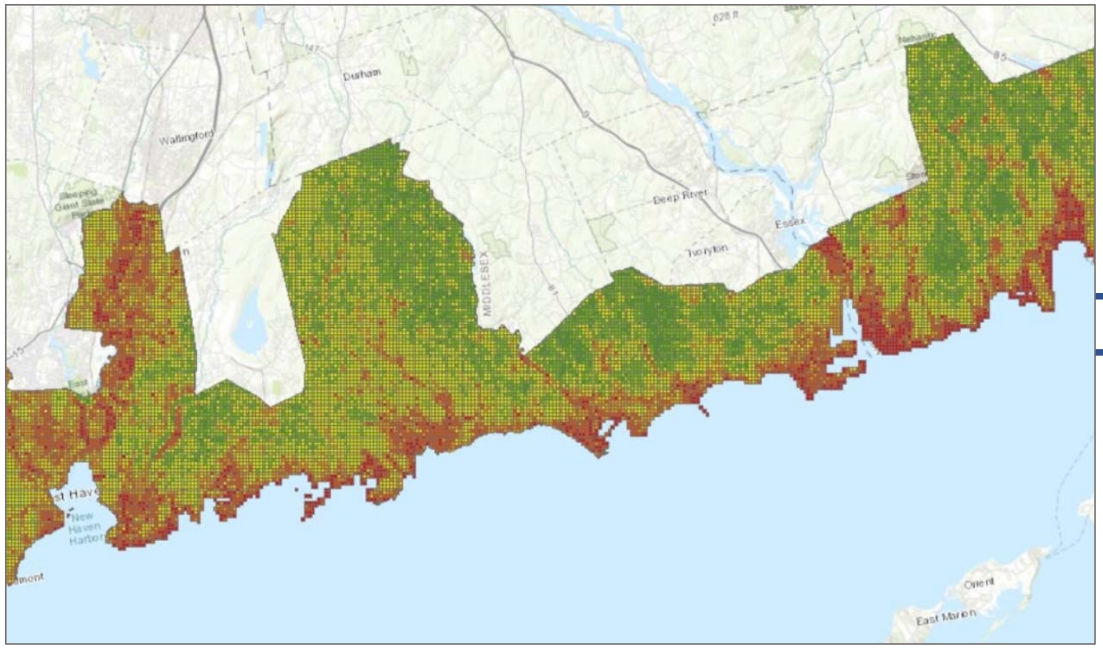
Identify the Opportunities

Resilient Connecticut Phase II Task 4

Regional Risk and Vulnerability Assessment & Zones of Shared Risk

1. Develop indicators to identify risk and vulnerabilities throughout the region
2. Develop SVI for the two counties
3. Develop methodology to identify Zones of Shared Risk
4. Develop a Climate Vulnerability Index using CIRCA's CVI

CVI to CCVI



Climate Hazards

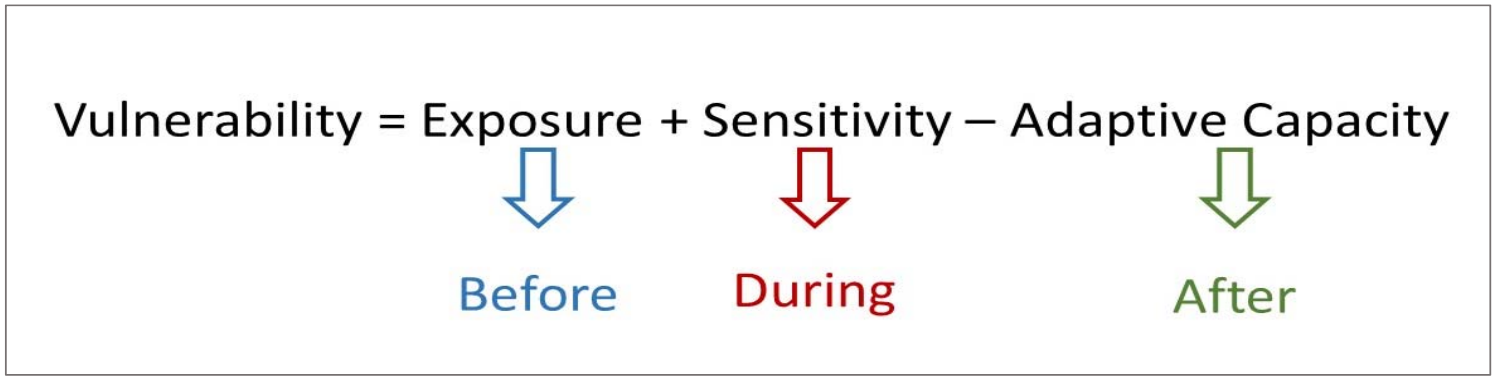
- Flooding
- Heat
- Wind

Key Terms

Exposure: the degree of the stress that the particular asset is going through with climate variability. Exposure includes the change, including magnitude and magnitude and frequency of extreme events.

Sensitivity: the degree to which a built, natural, or human system will be impacted by changes in climate conditions.

Adaptive Capacity: the ability of a system to adjust to changes, manage damages, take advantage of opportunities, or cope with consequences.

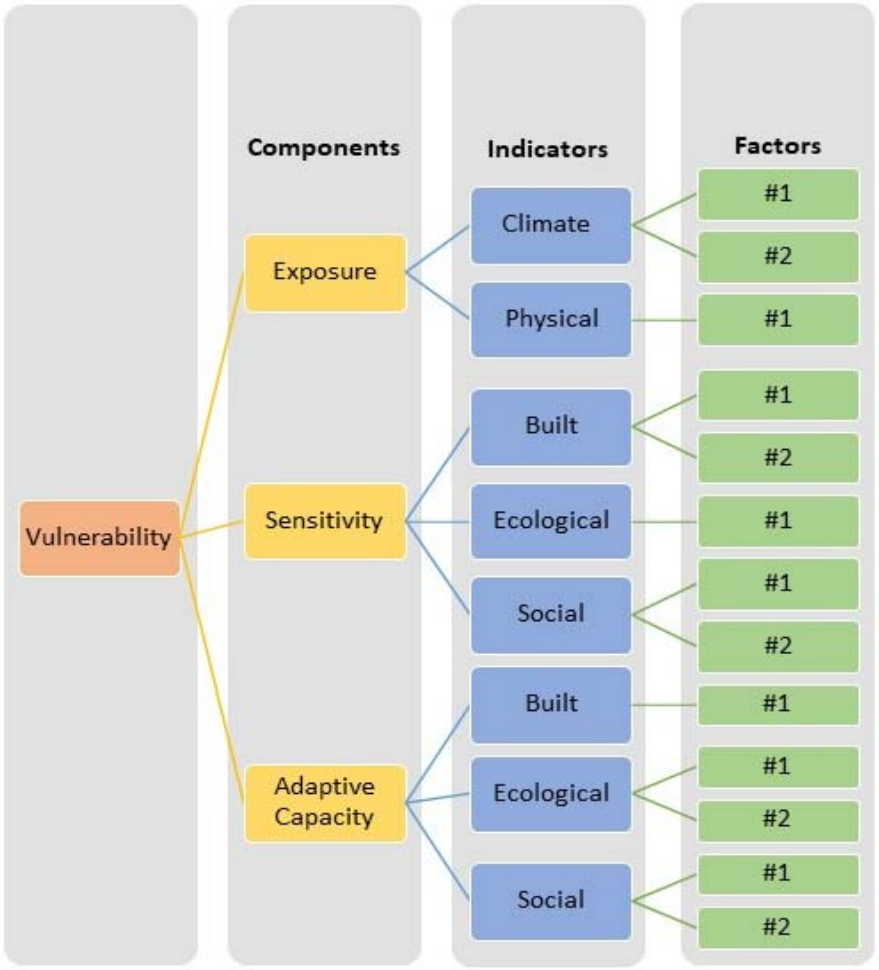


CCVI Hierarchy

3 **components** to vulnerability:

- Exposure
- Sensitivity
- Adaptive Capacity

Components are broken down into **indicators**, each indicator is comprised of several **factors**.



Flooding

EXPOSURE

Climate Stressor

- FEMA Riverine Zones
- CIRCA Sea Level Rise
- Storm Surge
- Tidal Range
- Precipitation

Physical

- Impervious Surfaces
- Erosion
- Elevation (pooling)
- Soil Drainage

Flooding

SENSITIVITY

Built

- Railways, Bus Yards, Rail Yards
- Streets (isolation)
- Septic Systems
- Private Wells
- Sanitary Sewer Infrastructure
- Building Density
- Critical Infrastructure
- Flooded Facilities

Ecological

- Critical Habitat
- Land Cover
- Distance to Waterbodies

Social

- Median Income
- Race and Ethnicity
- % under 5
- % over 65
- % unemployed
- Average no. per household
- % below FPL
- % over 25 without a HS Diploma
- Older than 5 with Disability
- Speaks English less than well
- Population Density

Flooding

ADAPTIVE CAPACITY

Built

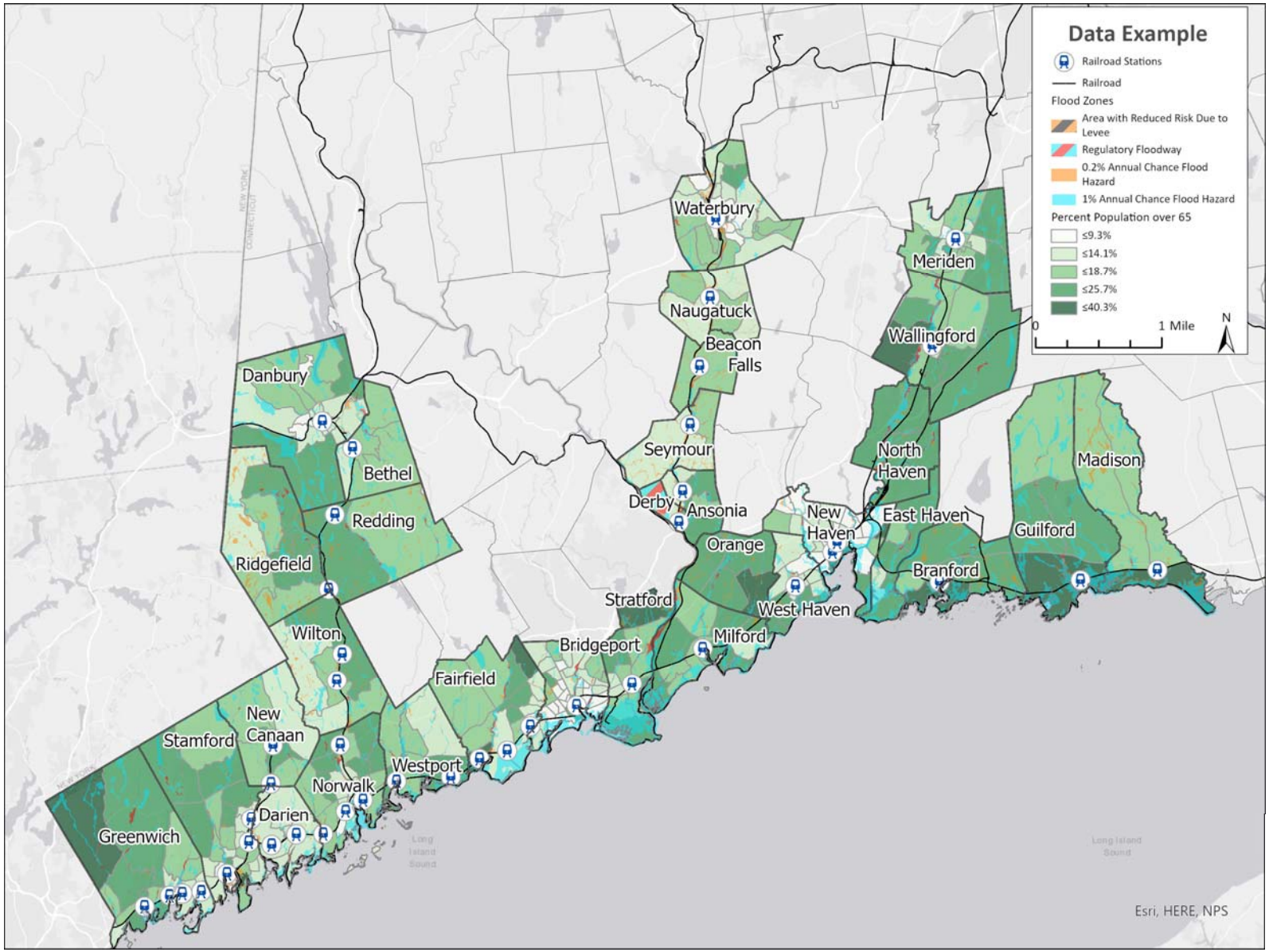
- Coastal Structures
- Major Roadway Access
- Distance to Health Facility
- Distance to Shelters
- LID Structures
- Water and Sewer Service Areas
- Regulatory Standards
- Riverine Flood Protection Systems
- Resilient Landscapes

Ecological

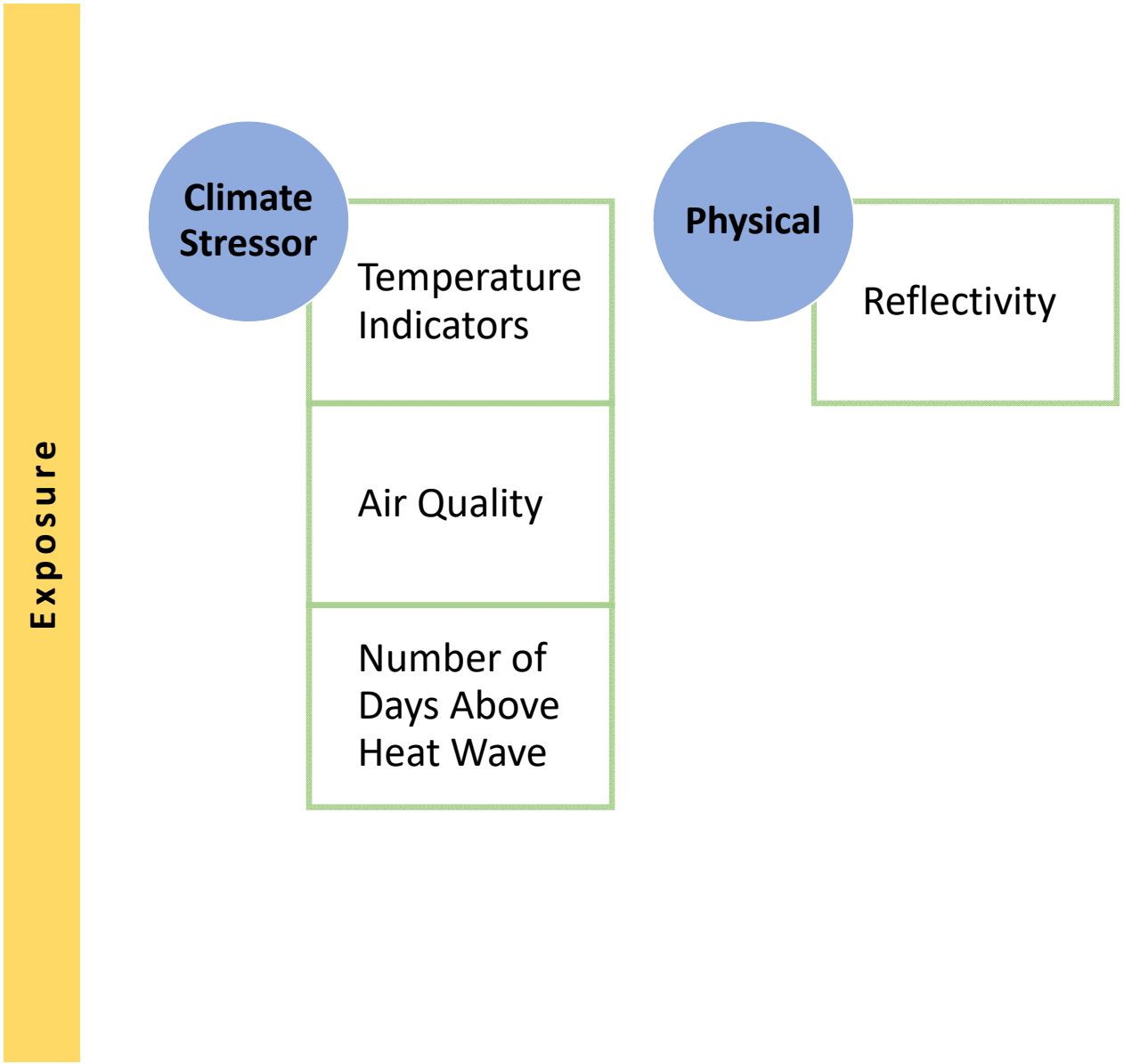
- Open Space in Flood Risk Areas
- Wetland Presence and Migration

Social

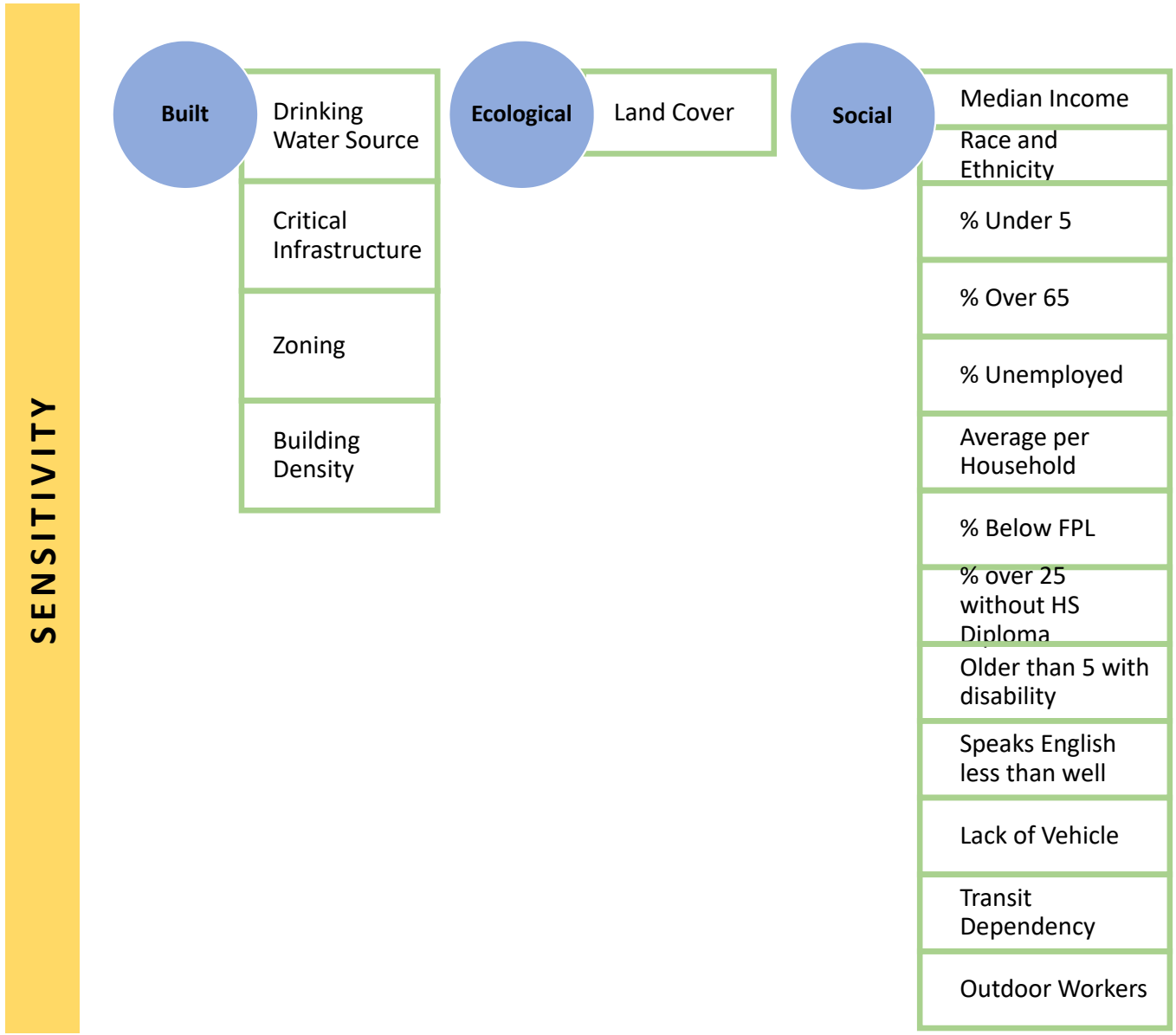
- Walk, Bike, Transit Score
- Religious Organizations per 10,000
- Civic Organizations per 10,000
- High Owner-Occupied Housing
- Generator Availability
- Emergency Services per Capita
- % with Property Insurance
- Emergency Communication
- LID Policies
- Multiple Sources of Income


Data Example
Railroad Stations
Railroad
Flood Zones
Area with Reduced Risk Due to Levee
Regulatory Floodway
0.2% Annual Chance Flood Hazard
1% Annual Chance Flood Hazard
Percent Population over 65
≤9.3%
≤14.1%
≤18.7%
≤25.7%
≤40.3%
0
1 Mile
N
Waterbury
Naugatuck
Beacon Falls
Meriden
Wallingford
Danbury
Seymour
North Haven
Madison
Bethel
Derby
Ansonia
New Haven
East Haven
Guilford
Redding
Orange
Ridgefield
Branford
Stratford
West Haven
Wilton
Bridgeport
Milford
Fairfield
New Canaan
Stamford
Westport
Norwalk
Darien
Greenwich
Long Island Sound
Esri, HERE, NPS

Heat

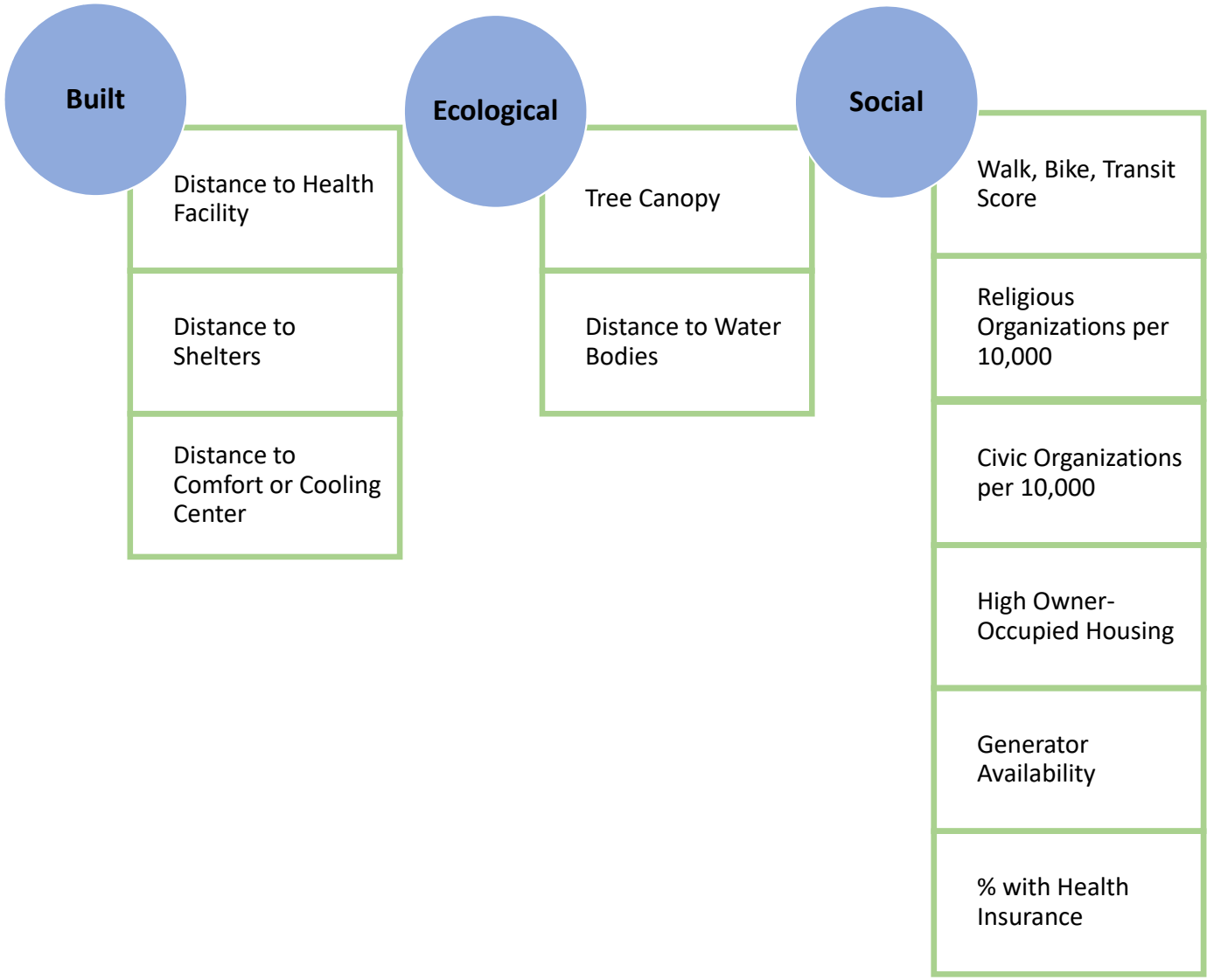

Exposure
Climate Stressor
Temperature Indicators
Air Quality
Number of Days Above Heat Wave
Physical
Reflectivity

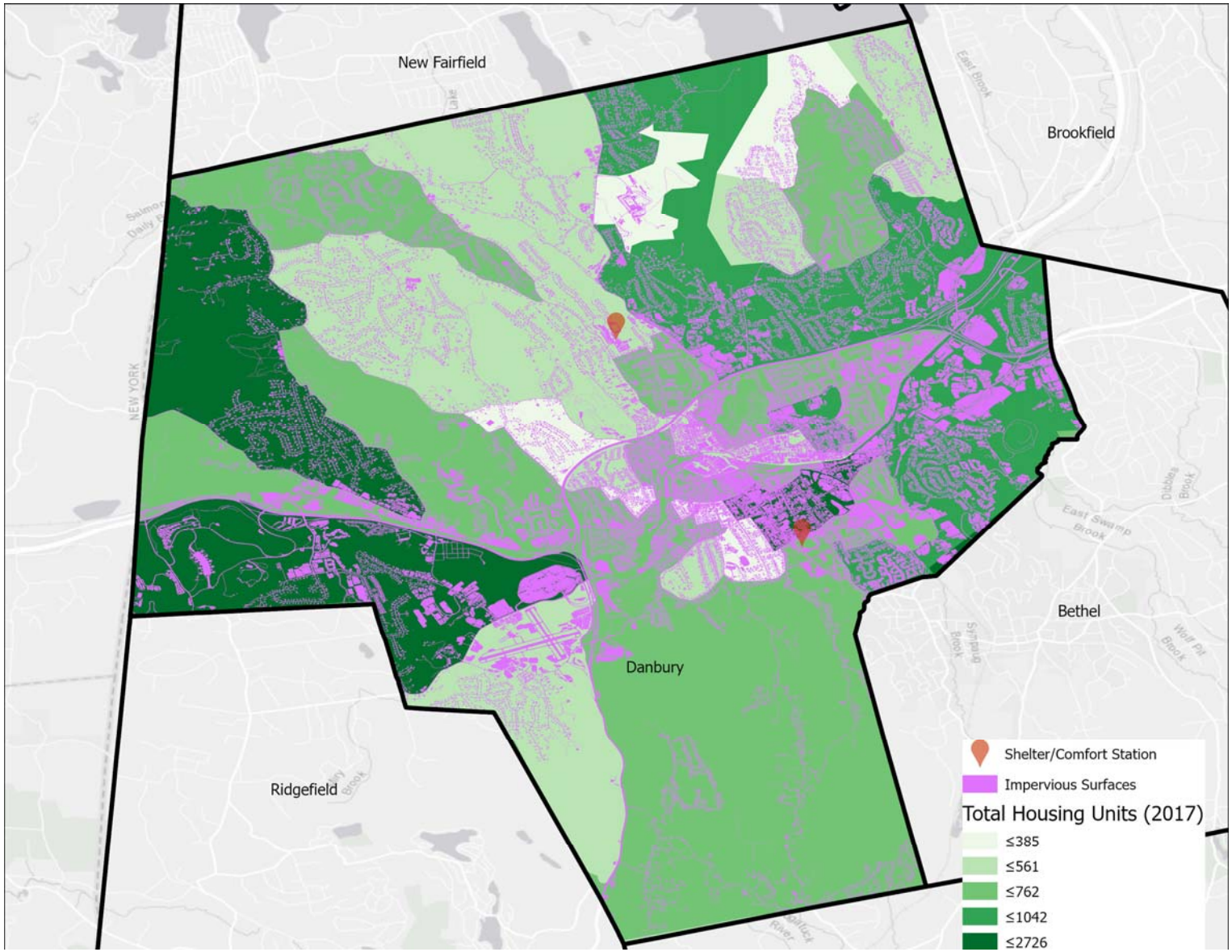
Heat


SENSITIVITY
Built
Drinking Water Source
Critical Infrastructure
Zoning
Building Density
Ecological
Land Cover
Social
Median Income
Race and Ethnicity
% Under 5
% Over 65
% Unemployed
Average per Household
% Below FPL
% over 25 without HS Diploma
Older than 5 with disability
Speaks English less than well
Lack of Vehicle
Transit Dependency
Outdoor Workers

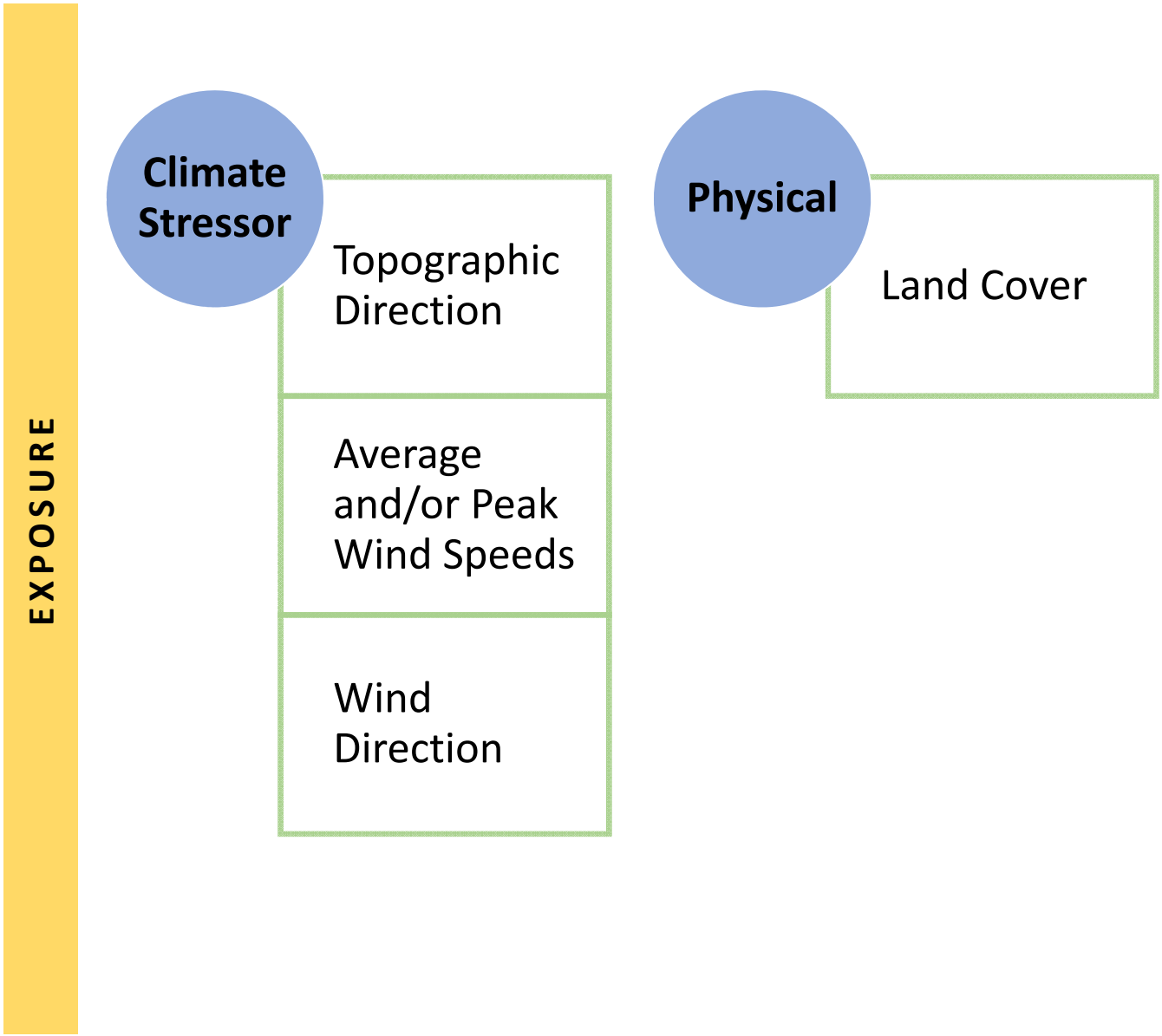
Heat

ADAPTIVE CAPACITY




New Fairfield
Brookfield
Danbury
Bethel
Ridgefield
NEW YORK
Shelter/Comfort Station
Impervious Surfaces
Total Housing Units (2017)
≤385
≤561
≤762
≤1042
≤2726

Wind


EXPOSURE
Climate Stressor
Topographic Direction
Average and/or Peak Wind Speeds
Wind Direction
Physical
Land Cover

Wind

SENSITIVITY

Built

- Electric Grid (or streets)
- Zoning
- Average Structure Age
- % of Dead Ends in a Community
- Building Density

Ecological

- Tree Canopy Density to Building Ratio
- Open Space to Building Density

Social

- Median Income
- Race and Ethnicity
- % under 5
- % over 65
- % unemployed
- Average no. per household
- % below FPL
- % over 25 without a HS Diploma
- Older than 5 with Disability
- Speaks English less than well
- Population Density
- Lack of Vehicle

Wind

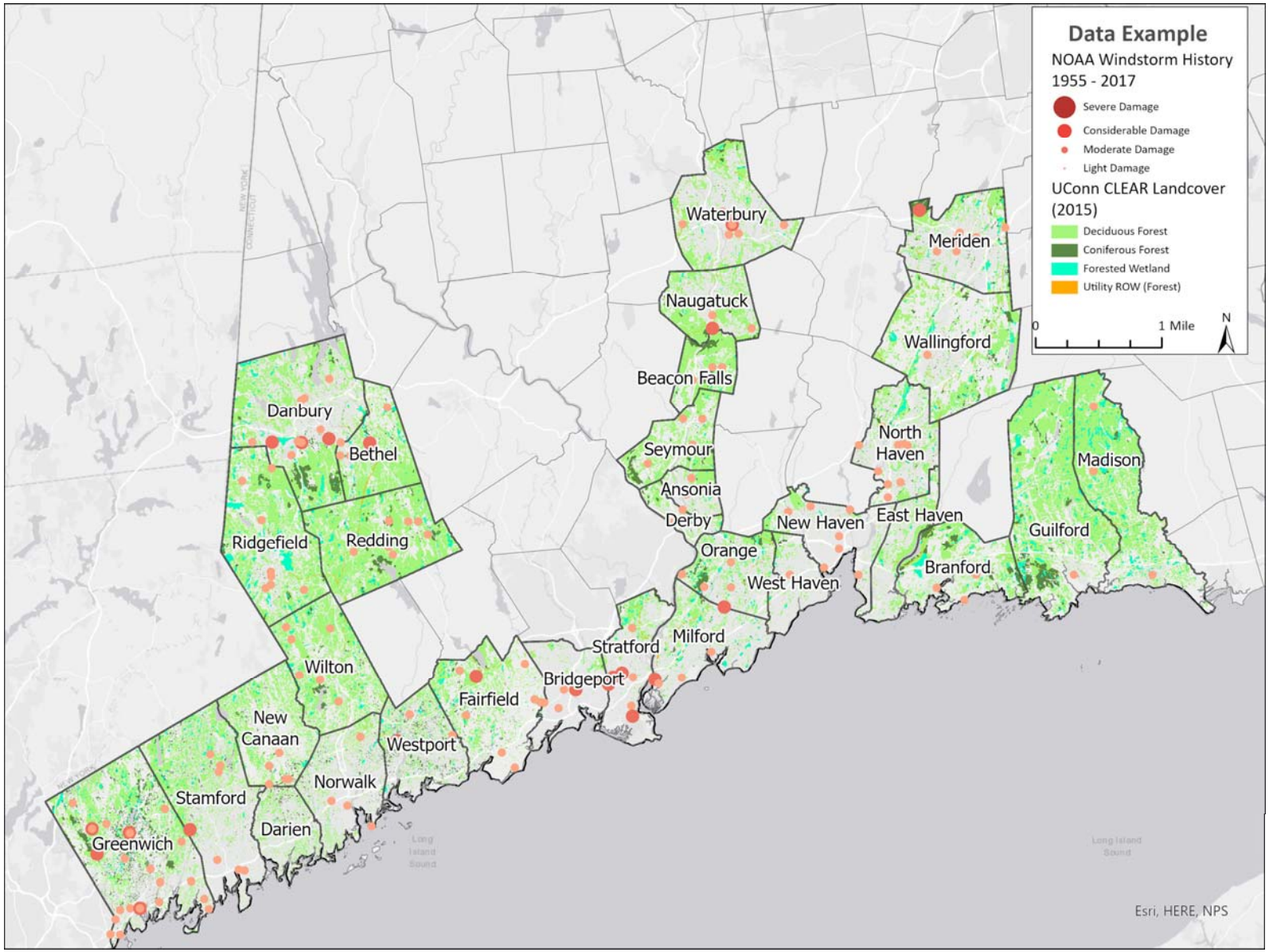
ADAPTIVE CAPACITY

Built

- CT Building Code Design Wind Speed
- Eversource, UI, Wallingford, SNEW Staging Locations or Satellite Offices
- Air Conditioning
- Distance to Shelters

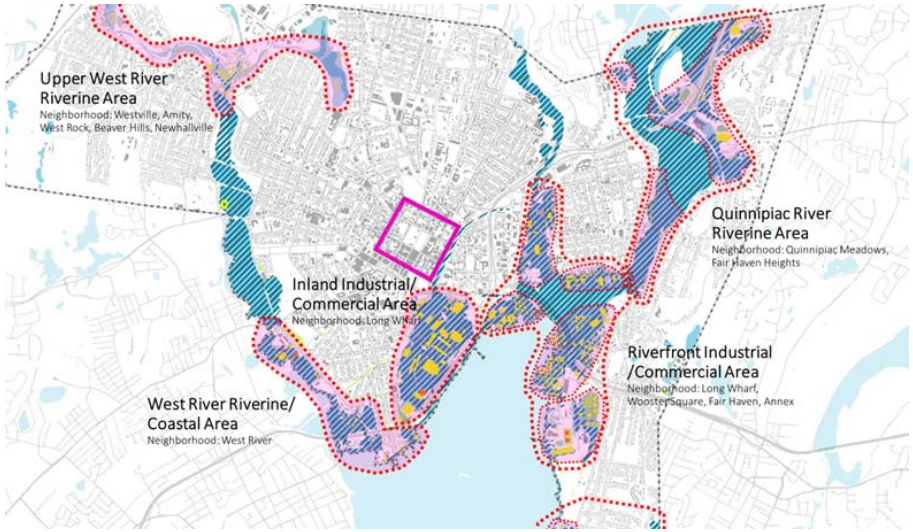
Social

- Walk, Bike, Transit Score
- Religious Organizations per 10,000
- Civic Organizations per 10,000
- High Owner-Occupied Housing
- Generator Availability
- Emergency Services per Capita
- % with Property Insurance
- Emergency Communication


Data Example
NOAA Windstorm History
1955 - 2017
Severe Damage
Considerable Damage
Moderate Damage
Light Damage
UConn CLEAR Landcover
(2015)
Deciduous Forest
Coniferous Forest
Forested Wetland
Utility ROW (Forest)
0
1 Mile
N
Waterbury
Meriden
Naugatuck
Wallingford
Beacon Falls
Danbury
Bethel
Seymour
North
Haven
Madison
Ansonia
Derby
New Haven
East Haven
Guilford
Orange
Branford
West Haven
Milford
Stratford
Wilton
Bridgeport
Fairfield
New
Canaan
Westport
Norwalk
Stamford
Darien
Greenwich
Ridgefield
Redding
Esri, HERE, NPS

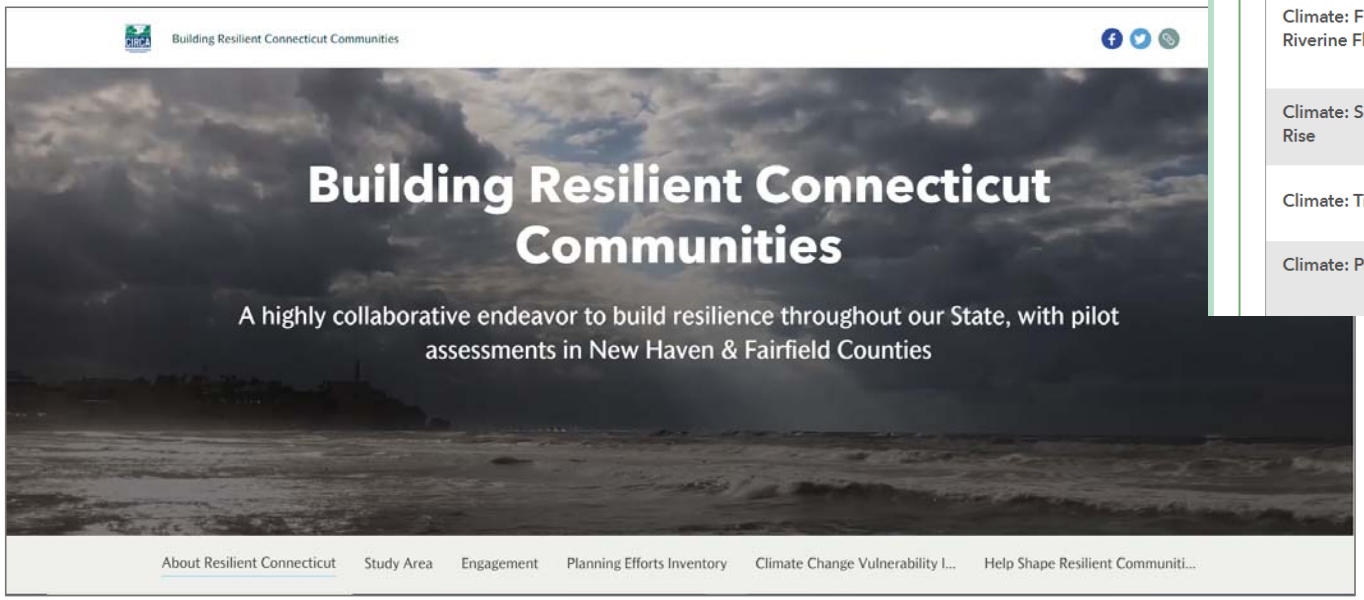
What Will the CCVI Inform?

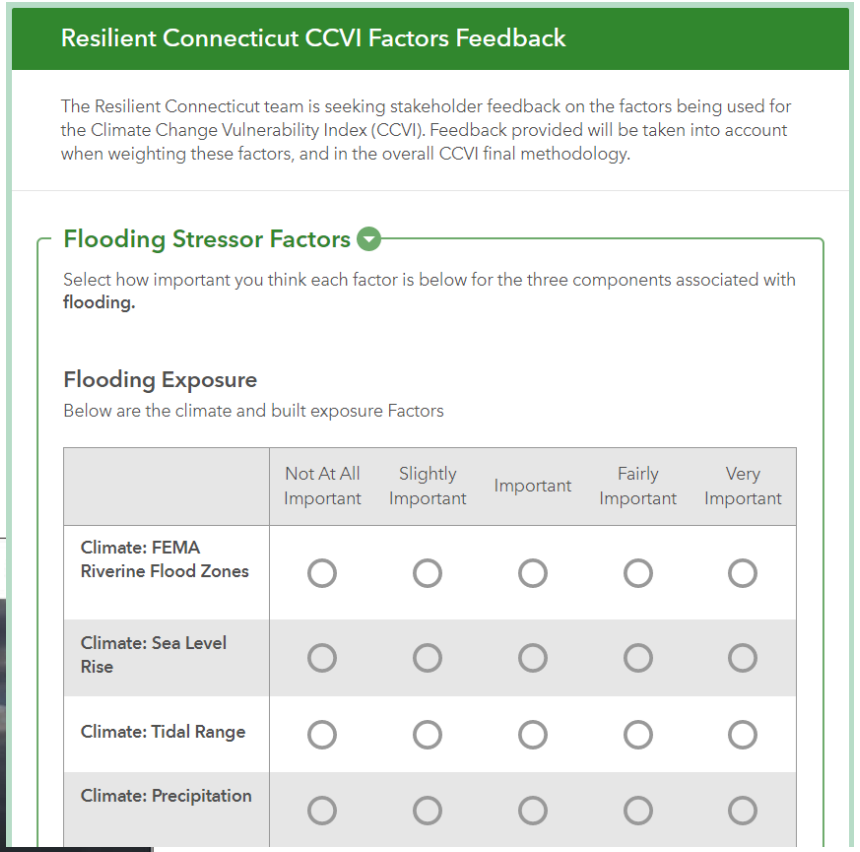
- ZSR efforts
- Phase II (and III) adaptation scenarios and project areas
- Collaborative future planning efforts outside of Resilient Connecticut
- Statewide CCVI



Next Steps…

- Collect stakeholder feedback
- Finalize methodology





Resilient Connecticut CCVI Factors Feedback

The Resilient Connecticut team is seeking stakeholder feedback on the factors being used for the Climate Change Vulnerability Index (CCVI). Feedback provided will be taken into account when weighting these factors, and in the overall CCVI final methodology.

Flooding Stressor Factors

Select how important you think each factor is below for the three components associated with **flooding.**

Flooding Exposure

Below are the climate and built exposure Factors

	Not At All Important	Slightly Important	Important	Fairly Important	Very Important
Climate: FEMA Riverine Flood Zones	○	○	○	○	○
Climate: Sea Level Rise	○	○	○	○	○
Climate: Tidal Range	○	○	○	○	○
Climate: Precipitation	○	○	○	○	○