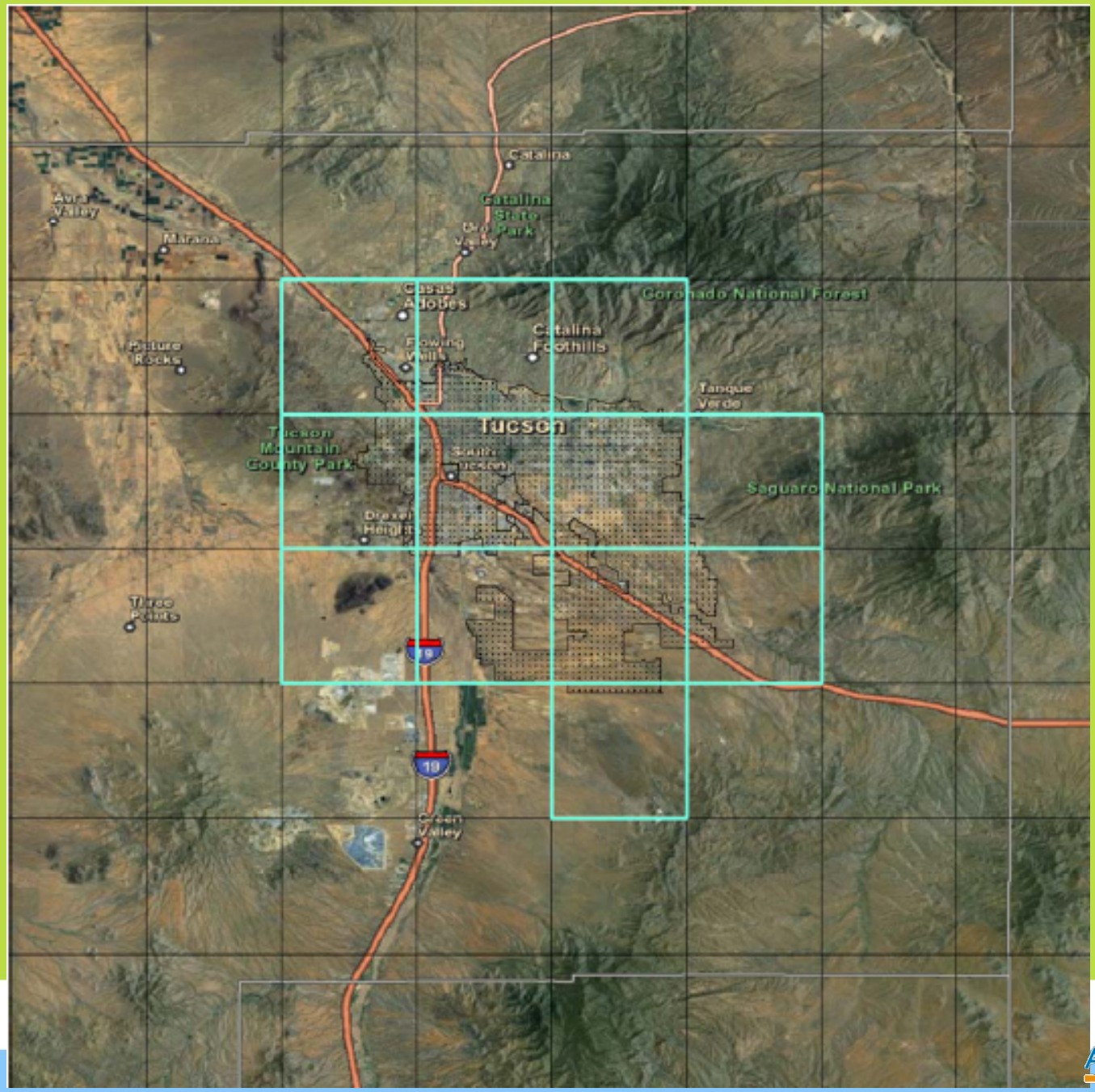
Tucson Vulnerability Assessment

Leslie Ethen
City of Tucson
Office of Conservation and Sustainable Development

Climate Vulnerability

- Vulnerability = Exposure, Sensitivity, Adaptive Capacity

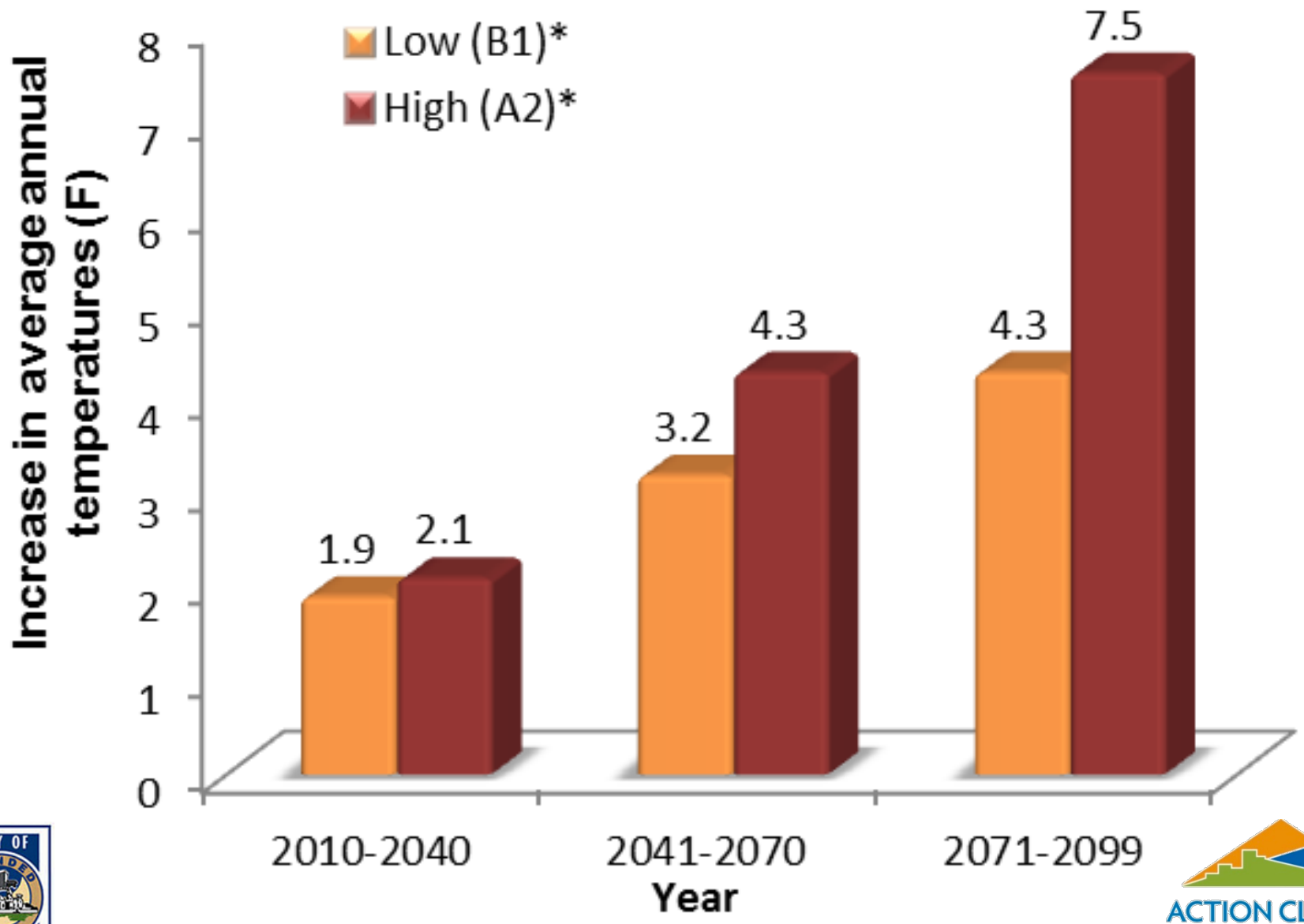
- Exposure = Science
- Sensitivity = We live in a desert
- Adaptive Capacity = We have a poor community



CITY OF FOUNDED 1775 TUCSON

ACTION CLIMATE TUCSON

Projected Annual Temperatures in Tucson



CITY OF TUCSON FOUNDED 1775

ACTION CLIMATE TUCSON

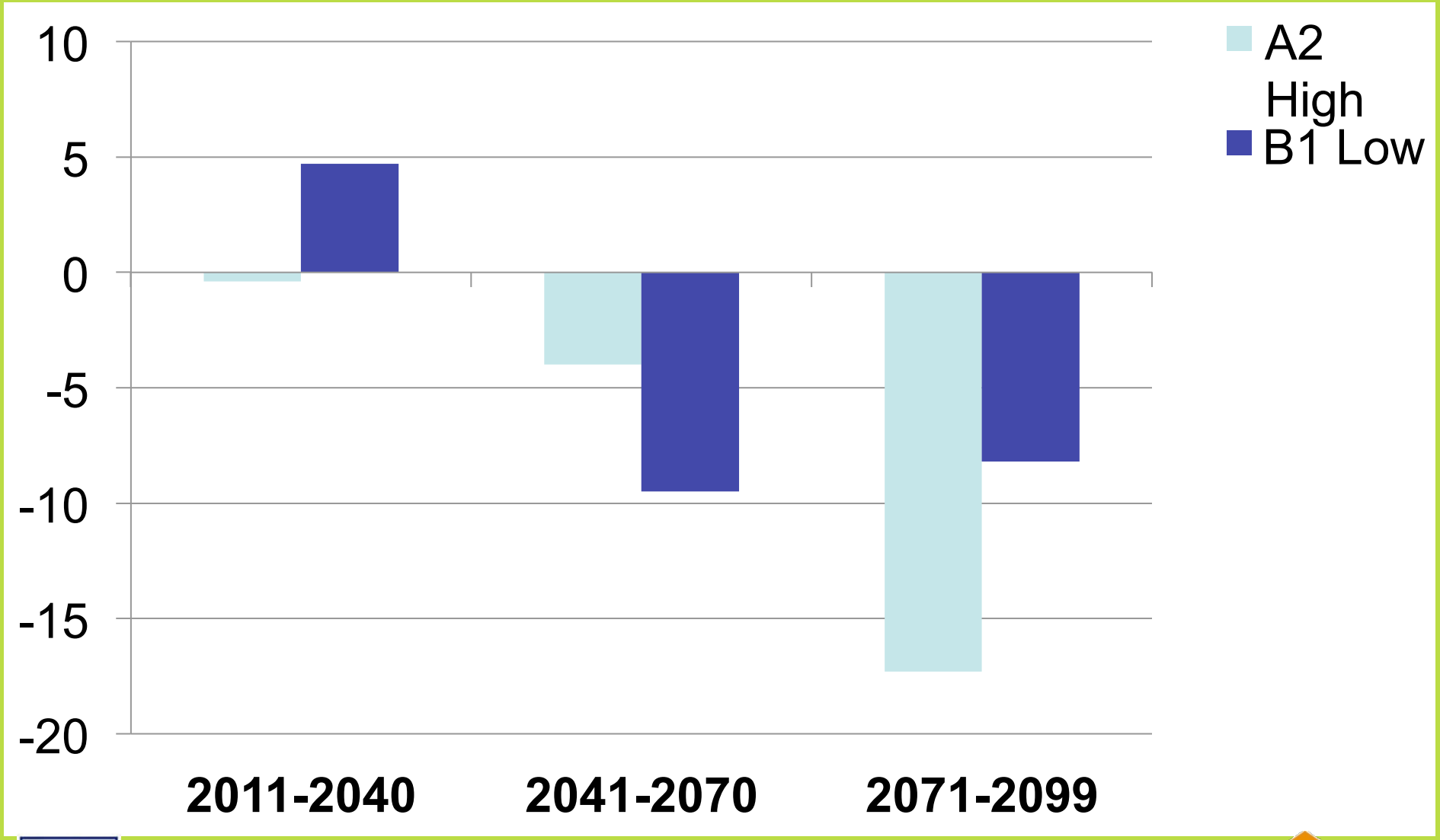
Tucson Exposure Data

- 4.3-7.5 degree increase by end of Century
  - Increase more in June-Nov
  - Increase more at night than day
  - More triple-digit days
  - Longer consecutive triple-digit days
  - UHI expected to add another 6-7 degrees!!!
- Precipitation
  - Drier, slightly
  - Fewer events, more intense, less effective precipitation
  - Humidity…?

CITY OF FOUNDED 1775 TUCSON

ACTION CLIMATE TUCSON

Tucson Precip - % Difference1971-2000



Winter

Temperatures Delivered by Evaporative Coolers

% Relative Humidity

Air Temperature

	2	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
75	54	55	57	58	59	61	62	63	64	65	66	67	68	69	70	71	72
80	57	58	60	62	63	64	66	67	68	69	71	72	73	74	76	76	77
85	61	62	63	65	67	68	70	71	72	73	74	75	76	77	79	81	
90	64	65	67	69	70	72	74	76	77	78	79	81	82	83	84	86	
95	67	68	70	72	74	76	78	79	81	82	84	85	87				
100	69	71	73	76	78	80	82	83	85	87	88						
105	72	74	77	79	81	84	86	88	89								
110	75	77	80	83	85	87	90	92									
115	78	80	83	86	89	91	94										
120	81	83	86	90	93	95											
125	83	86	90	93	96												

Optimum conditions for Evaporative Coolers

Source: Ed Phillips, Arizona Almanac

CITY OF TUCSON FOUNDED 1775

ACTION CLIMATE TUCSON

Impacts and Sectors (and Elements)

- Impacts
  - Extreme heat
  - Extreme cold
  - Drought
  - Wind
  - Monsoon
  - Flooding
  - Wildfires
- Sectors
  - Households
  - Parks/Open Space
  - Natural Ecosystems
  - Infrastructure
  - Transportation
  - Businesses
  - Food Security*
- Elements
  - Physical elements
  - Inputs, resources
  - Outputs
  - Processes

CITY OF FOUNDED 1776 TUCSON

ACTION CLIMATE TUCSON

Assessing Impacts

	Criteria							
	Decreases Quality of Life	**Critical inter-connectivity to other issues**	**Reduces Economic Sustainability**	**Increases GHG Emissions**	**Decreases Human Health and Safety**	**Decreases or Threatens Equity**	**Cost of Impacts**	Yes = 3 points Potential = 2 points Limited = 1 points No = 0 points
Extreme Heat	**Potentially**--Though short duration events, extreme heat can negatively impact urban infrastructure in a variety of ways. Impact will vary based on sector and populations groups. Direct effects include increased cooling costs, additional repair costs, and potential loss of service.	**Yes** - Extreme heat will affect multiple infrastructure segments simultaneously and exacerbate impacts. Increased demand for electricity for cooling with increase demand for water stressing both systems.	**Yes** - For the utilities extreme heat will increase costs of maintenance and could cause structural damage. Particularly for vulnerable low income segments of the populations extreme heat will Increase demand and cost for utilities, electricity, water…etc.	**Yes** - Increased demand for air conditioning and cooling from conventional energy sources create increased emissions.	**Potentially** -- Indirect or secondary impacts of infrastructure stress from extreme heat and/ or failure of primary infrastructure system could affect human health and safety.	**Yes** - Increasing burden on low income populations from increased costs of electricity and water and those particularly dependent on infrastructure could further threaten equity across Tucson	**Potentially large** - Requirement to upgrade infrastructure systems to be prepare for and capable of handling increased heat stress and demand may be substantial. Increased maintenance costs along with potential structural damage will increase costs to utilities and in turn increase costs to consumers.	19

CITY OF FOUNDED 1775 TUCSON

ACTION CLIMATE TUCSON

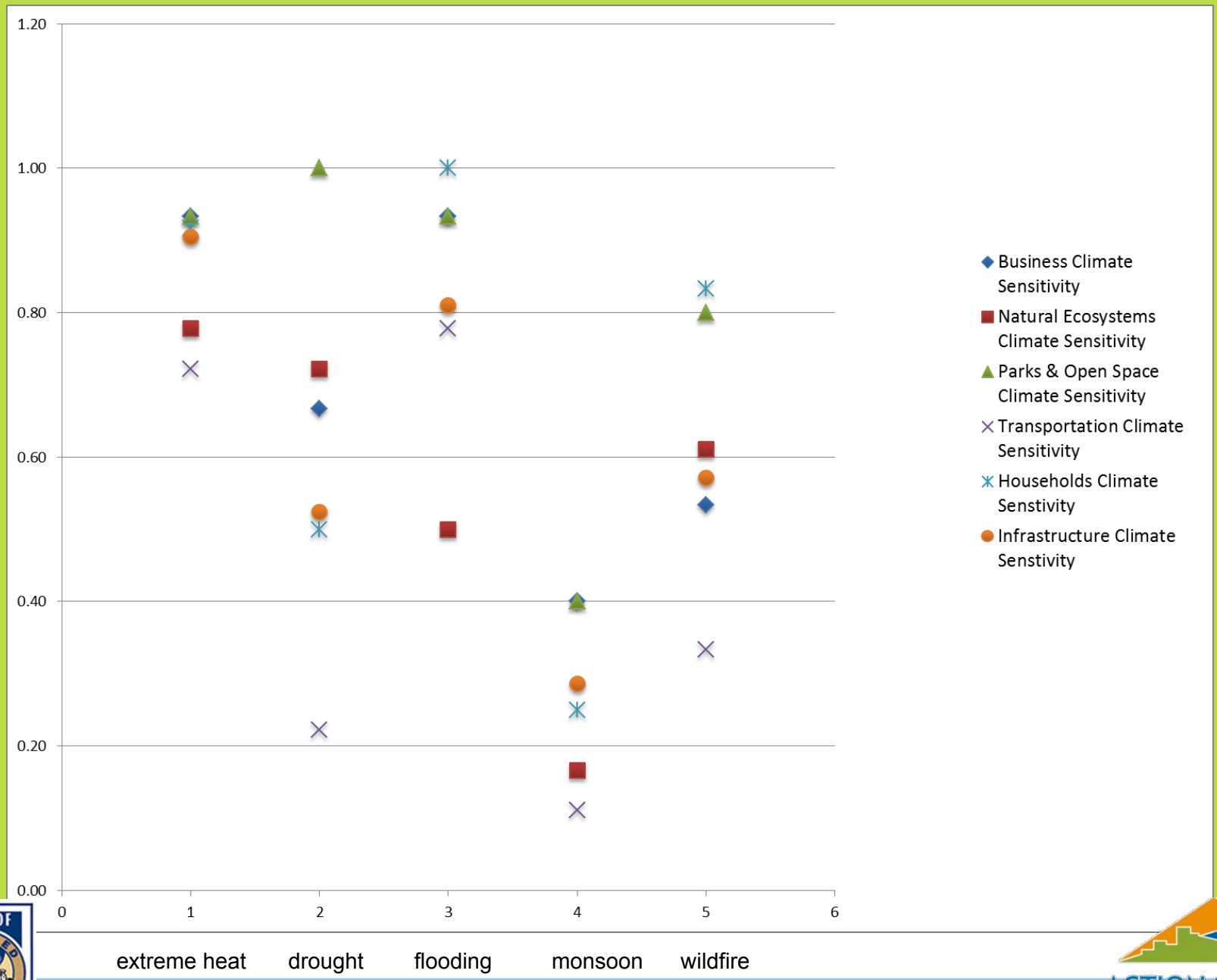
Prioritization

Climate Vulnerability Ranking

Vulnerability = (Potential climate exposure) x (Sensitivity)

Potential Climate Exposure	Sensitivity			
	Slight	Moderate	High	Severe
Very High				
High		☀	💧	
Medium				
Low				

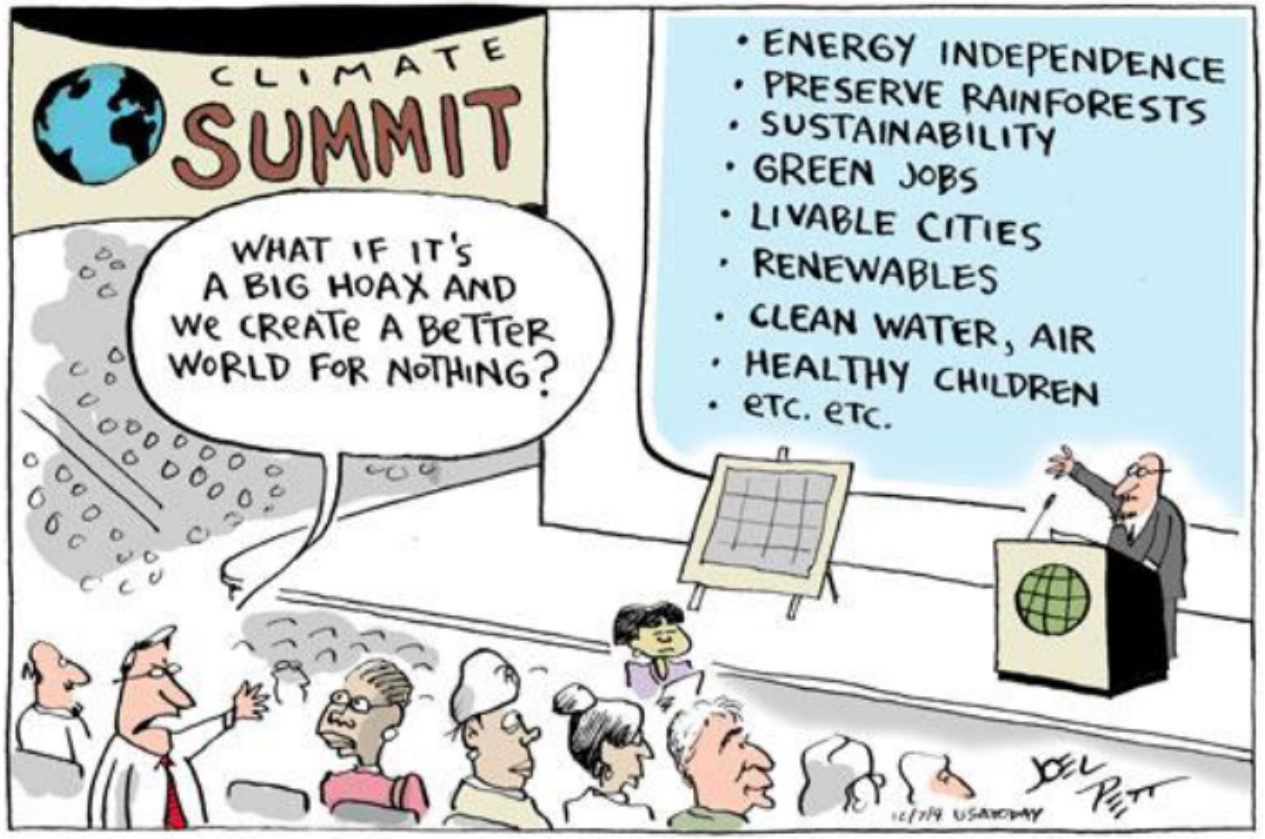
☀ = Extreme Heat 💧 = Flooding


1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
1
2
3
4
5
6
extreme heat
drought
flooding
monsoon
wildfire
Business Climate Sensitivity
Natural Ecosystems Climate Sensitivity
Parks & Open Space Climate Sensitivity
Transportation Climate Sensitivity
Households Climate Senstivity
Infrastructure Climate Senstivity

Messaging: Hotter, Drier, So What?

- Temp and precip changes are **drivers**
- But **temporal variability** hidden by annual averages
- Trends are important (climate change), but problem is increasingly **climate extremes**
- Also we need to look at **actual impacts** (many of which are interrelated)
- Climate change can exacerbate **existing risks**, problems
- Long-term trends + compounding + new extremes = significant impacts

Questions?



Leslie Ethen
520-791-4675
Leslie.Ethen@tucsonaz.gov