Developing a COMMUNITY RESILIENCE PLAN

MVRPC Sustainability Roundtable | June 2019 |

AGENDA

Introductions

Resilience and Risk Perspectives

Resilience Analysis based on Emerging Best Practices

Description of Climate Resilience Plan

Methodology for Developing and Monitoring the Plan

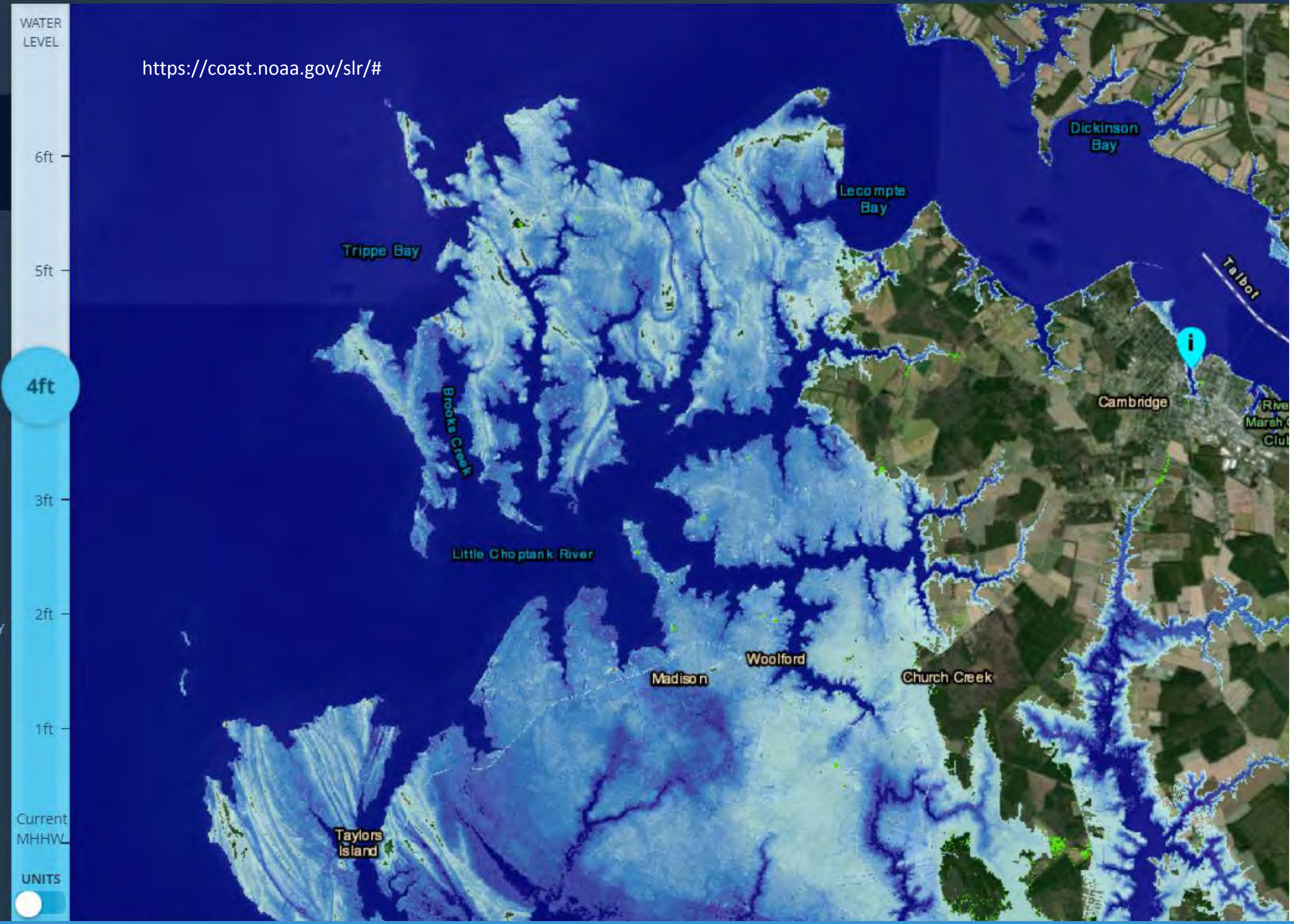
Why the Recent Focus on Resiliency?

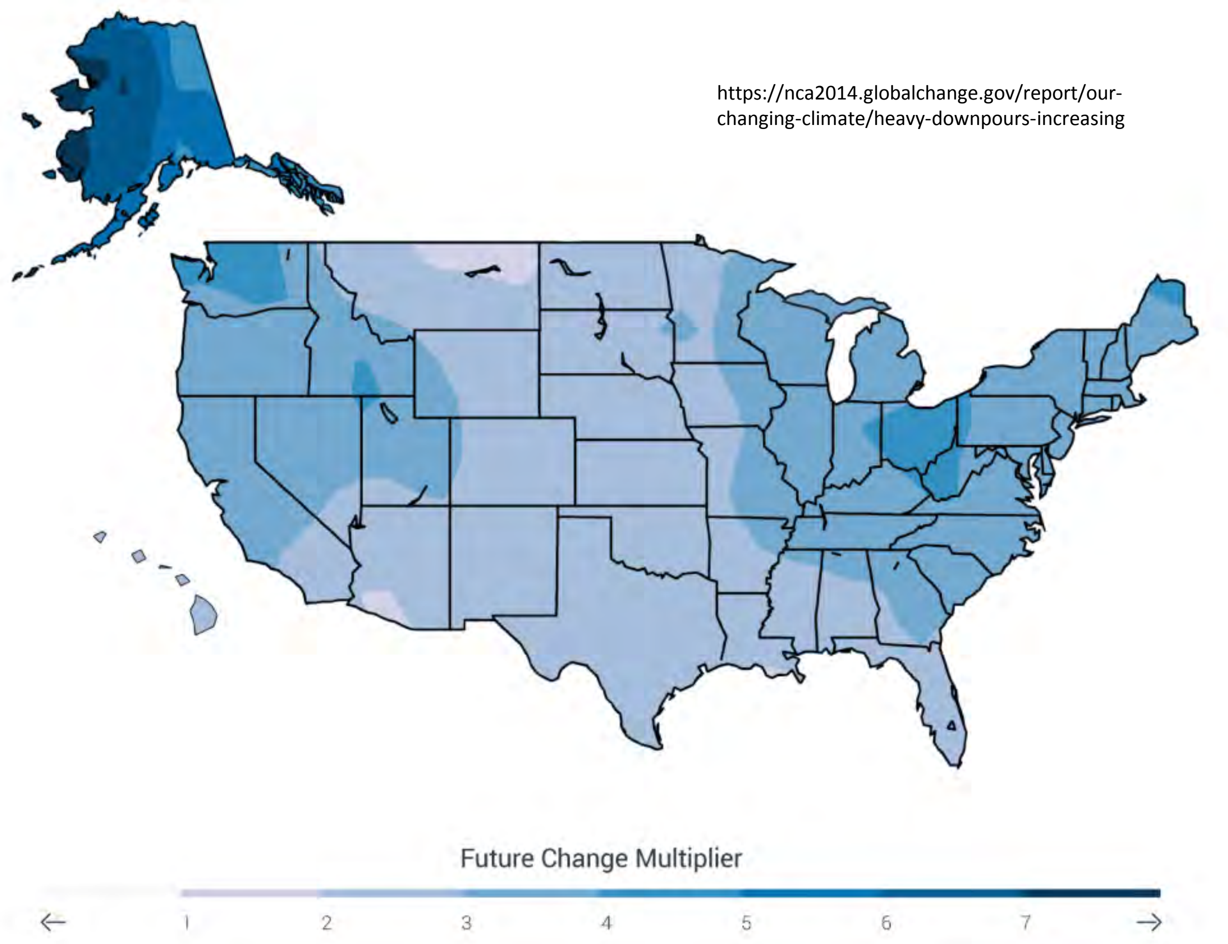
https://wtop.com/howard-county/2018/06/ellicott-city-keep-flooding-local-areas-risk/

http://www.baltimoresun.com/news/maryland/bs-md-ha-recovery-20180901-story.html

http://www.wmdt.com/news/maryland/parts-of-crisfield-still-underwater-following-second-noreaster/713429036

A RASH OF EXTREME WEATHER EVENTS...





Why the Recent Focus on Resiliency?

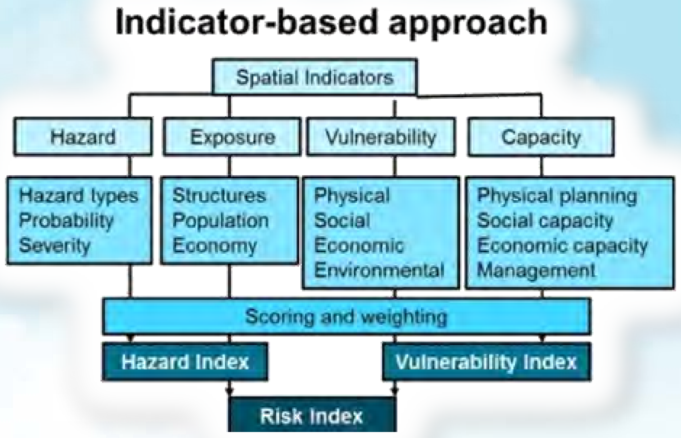
LOOMING CHALLENGES...

Applied Assessment Approaches

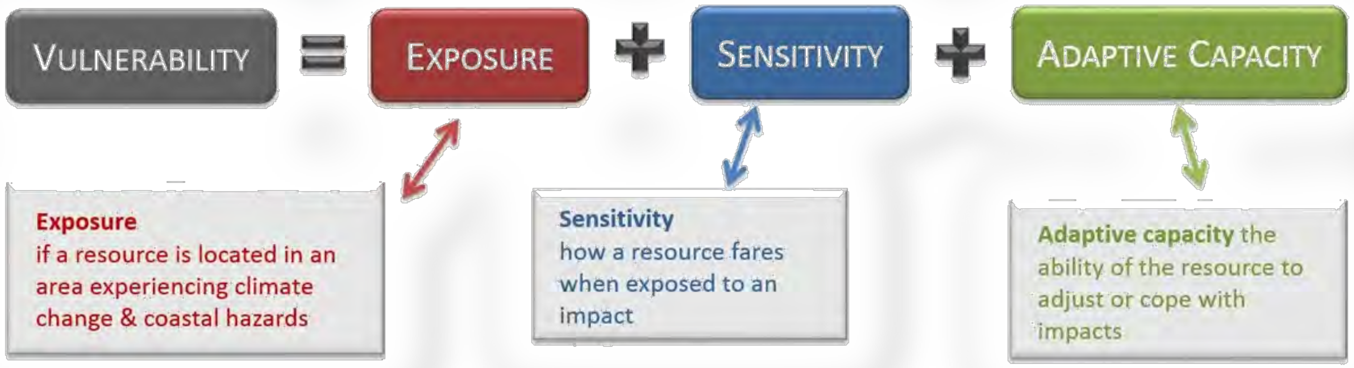
MATRIX

Likelihood \ Impact	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Low Med	Medium	Med Hi	High	High
Likely	Low	Low Med	Medium	Med Hi	High
Possible	Low	Low Med	Medium	Med Hi	Med Hi
Unlikely	Low	Low Med	Low Med	Medium	Med Hi
Very Unlikely	Low	Low	Low Med	Medium	Medium

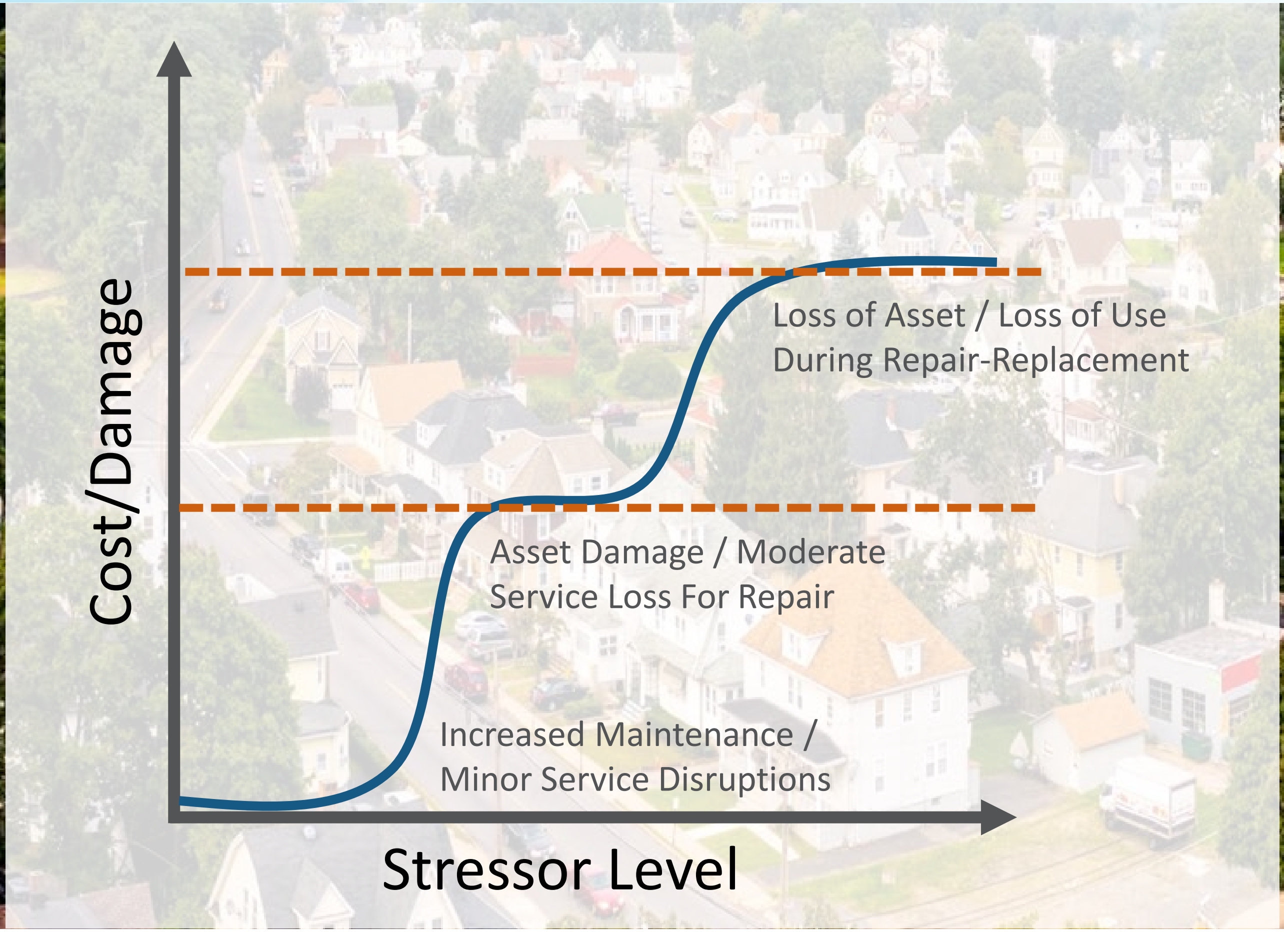
INDICATOR



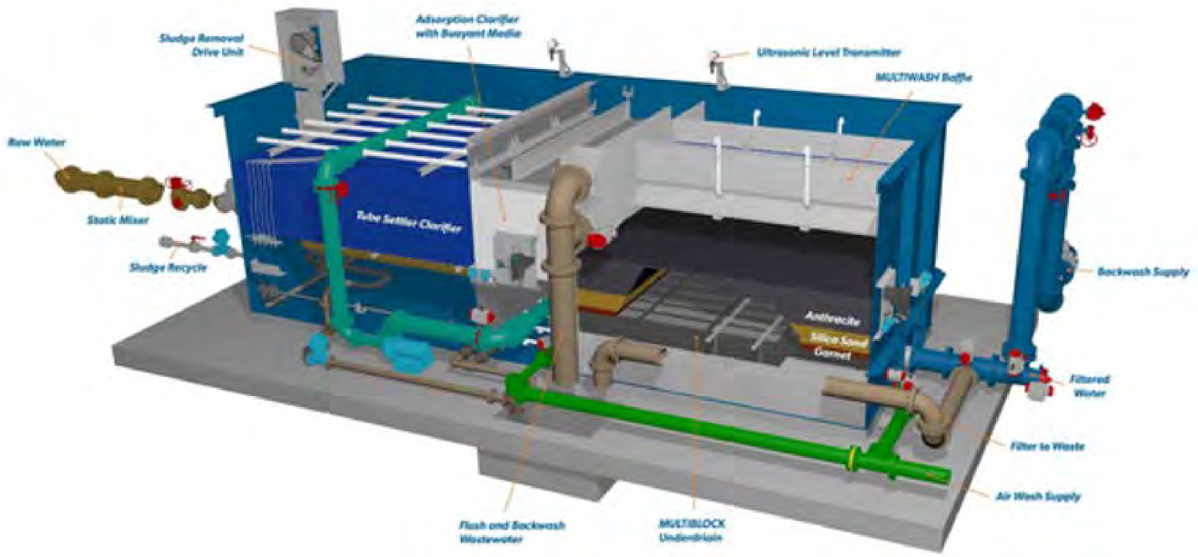
CLIMATE VULNERABILITY



Technical Assessments of Risks to Assets and Communities



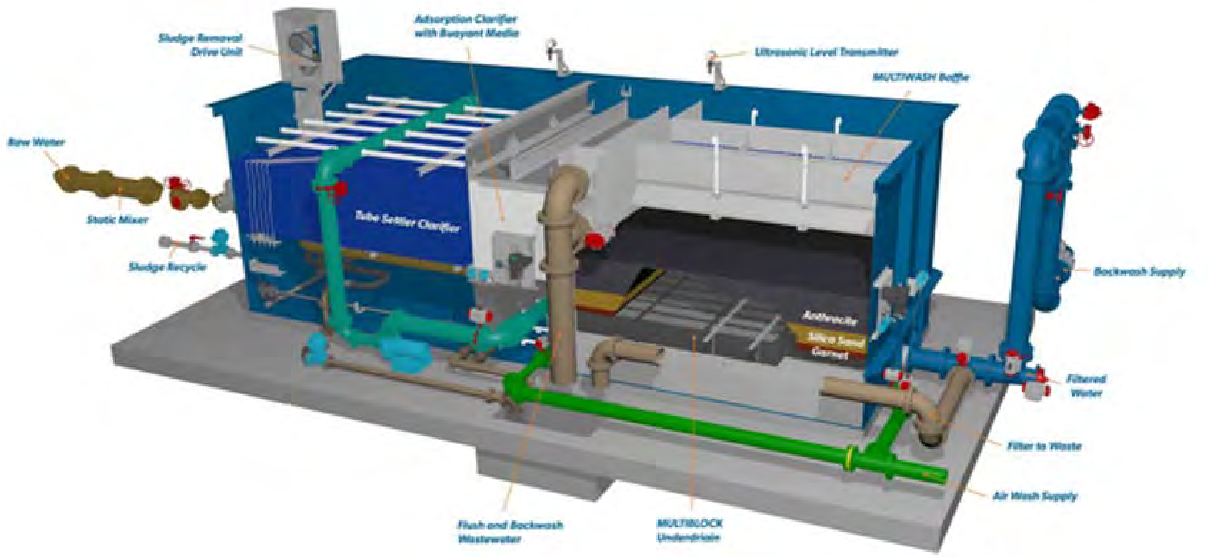
VULNERABILITY RANKING



Asset Ranking

Exposure Score	**24**
Sensitivity Score	**28**
Adaptive Capacity Score	**29**
Total Asset Score	**81**

QUANTIFIED ASSET RISK



Impact Assessment for 100 Year Flood

Repair Costs	**$15M**
Outage Period (Days)	**28**
Households in Service Area	**500**
Low Income	**200**
Business Impacted	**290**
Community	**125**

Understanding Risk
Investment Assessment Methods

Risk: Flooding
Likelihood: 1:500 Year Event
Discount Rate: 7%
Analysis Period: 80 Years

Resiliency Investment: $**30**M

"Houston is experiencing its third '500-year' flood in 3 years. How is that possible?"

—Washington Post, 2017

wsp

[We are 99% sure that the future (storm, climate, etc.) will be not exactly like the calculated conditions derived from the model we are showing here.]

Considerations for Modeling

Risk Assessments – Considerations/Measure of Equity
Current Practice

Results of Relying on Cost Metrics Alone

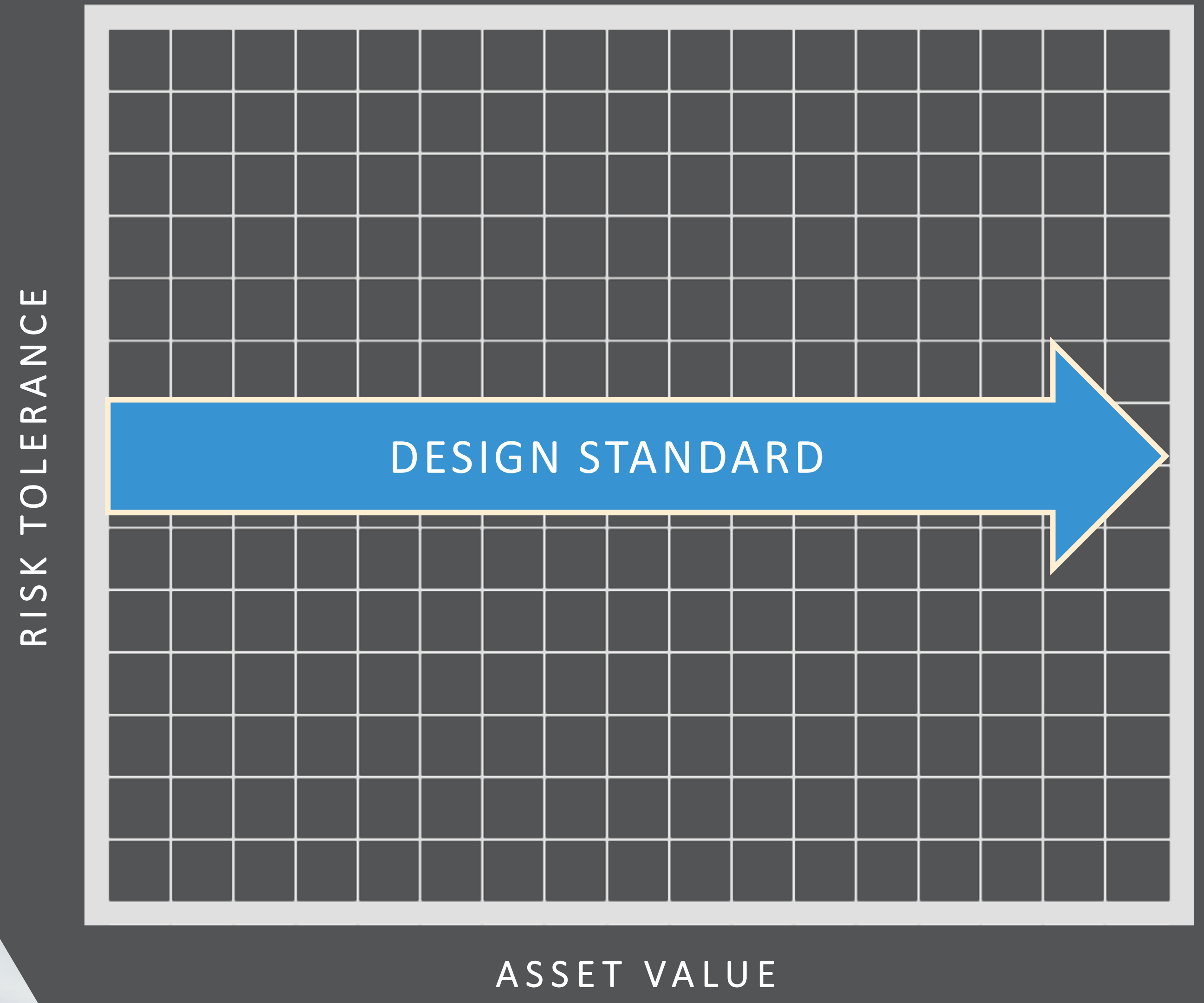
Needed Transition for Effective Resiliency

Historical perspectives

Limited data basis

Precedent-based

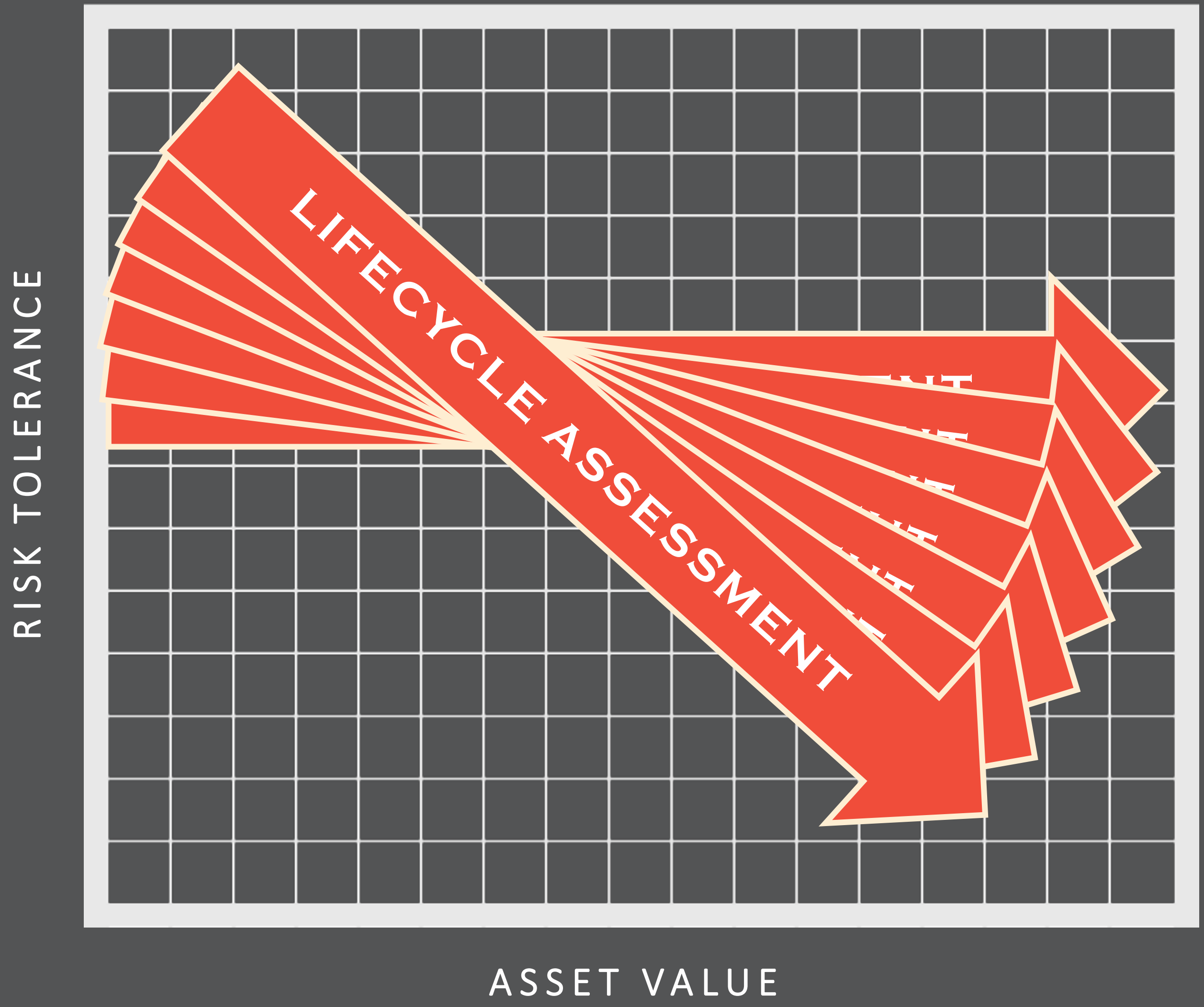
TRADITIONAL



Needed Transition for Effective Resiliency

- Event damage
- Repair/outage periods
- Social and environmental costs
- True asset value
- Changing stressor conditions
- Recurrence uncertainties
- Potential future conditions

RISK-BASED APPROACH



"Climate change could end cheap credit for local governments, Moody's reports."

—David Pendered, SaportaReport
December 4, 2017

"Governments that are at risk for higher risks of climate shock are asked to explain how they are prepared to deal with the weather events associated with climate shocks."

Key Driver of Change

Moody's

A Community Climate Resilience Plan

Ultimately – It Requires Choices

Information Informs Decision-Making

Risk Analysis = Better Information

TRAINING AGENDA

Description of Climate Resilience Plan

Key Steps of a Successful Methodology for Building the Plan

- » Provide general background knowledge of each of the steps
- » Identify best practices

Wrap up with Q&A

What is a Climate Resilience Plan?

Identifies actions that can be taken to reduce the impacts of a climate-related hazardous events and increase the ability to return to "normal" as quickly as possible.

- Focus on resilience
- Long-term planning window
- Comprehensive
- Cross-sector/interdisciplinary
- Forward-looking
- Flexible content & format

Climate Resilience Plan

- Executive Summary
- Description of the System
- Current and Future Climate-Related Hazards
- Hazard-Related Risks & Consequences
- Strategies for Climate Resilience
- Implementation Plan of Strategies

Methodology to Inform an Effective Climate Resilience Plan

Methodology to Inform an Effective Climate Resilience Plan

Key Stakeholders

Identify

1. Identify: A few key questions can be drivers for public or private entities for this process

	SERVICES	INDUSTRY	COMMUNITY	LEADERS
Key Questions	What key services does your organization rely on?	What key industries does your organization rely on?	Who is your community that supports your organization and may be impacted?	Who are the influential leaders at your organization or in your sphere?
Examples	Sewer & wastewater management, utility providers, transportation agencies, etc.	Tourism, fishing, farming, food and freight distributors, unions, etc.	Civil society, non-profits, neighborhood associations, employees, customers, etc.	Shareholders, executives, community leaders, elected officials, etc.

Local

Global

The Importance of Identifying Socially Vulnerable Populations

Socially vulnerable populations may be defined by:

Individuals who are unequally exposed to the impacts of climate change within the context your organization operates within.

The Importance of Identifying Socially Vulnerable Populations

Identify

Socially vulnerable populations are unequally at risk of climate stressors and shocks.

Socially vulnerable populations may experience:

01

Preparedness:
- Higher likelihood of living in substandard housing
- Higher likelihood of living near industrial facilities

02

Response:
- Higher likelihood to face challenges evacuating & finding shelter

03

Recovery:
- Higher financial risk/cost burden
- Limits to mobility
- Limited access to public services

04

Mitigation:
- Higher likelihood of moving to other at-risk locations
- Higher likelihood of being impacted by variations in housing prices

Engagement

2. ENGAGE: Continue to engage with these groups throughout the entire lifecycle of developing a climate resilience plan to:

- ✓ *Build awareness*
- ✓ *Gather feedback to inform the process*
- ✓ *Build political will and legitimacy*

Identify

What are strategies to communicate with unequally vulnerable populations?

- Work with non-profits and local groups to develop trust
- Identify relevant leaders
- Develop multi-lingual materials and community forums
- Provide meaningful opportunities for dialogue

Articulate The “Vision” and The “Goals”

Identify

Determine the “Vision”

What do you want to achieve…

a) A functioning system that mirrors today (aka, status quo but resilient to climate)

b) An “improved” future environment that is resilient

Building on a legacy of innovation, Boulder will cultivate a creative spirit to adapt to and thrive in a changing climate, economy, and society.
Boulder, CO

In supporting our shared values, as our company builds forward we will ensure resiliency to climate change as well as healthy and safe conditions for our employees under existing and future hazards.

Determine the goals

- Functioning facilities during and after hazard events
- Economic vitality such as attracting businesses or continuing our net growth
- Social vitality such as recreational facilities
- Climate equity

wsp

Key Elements in Your System

MUNICIPALITY

COMPANY

AGENCY

Identify Climate Hazards

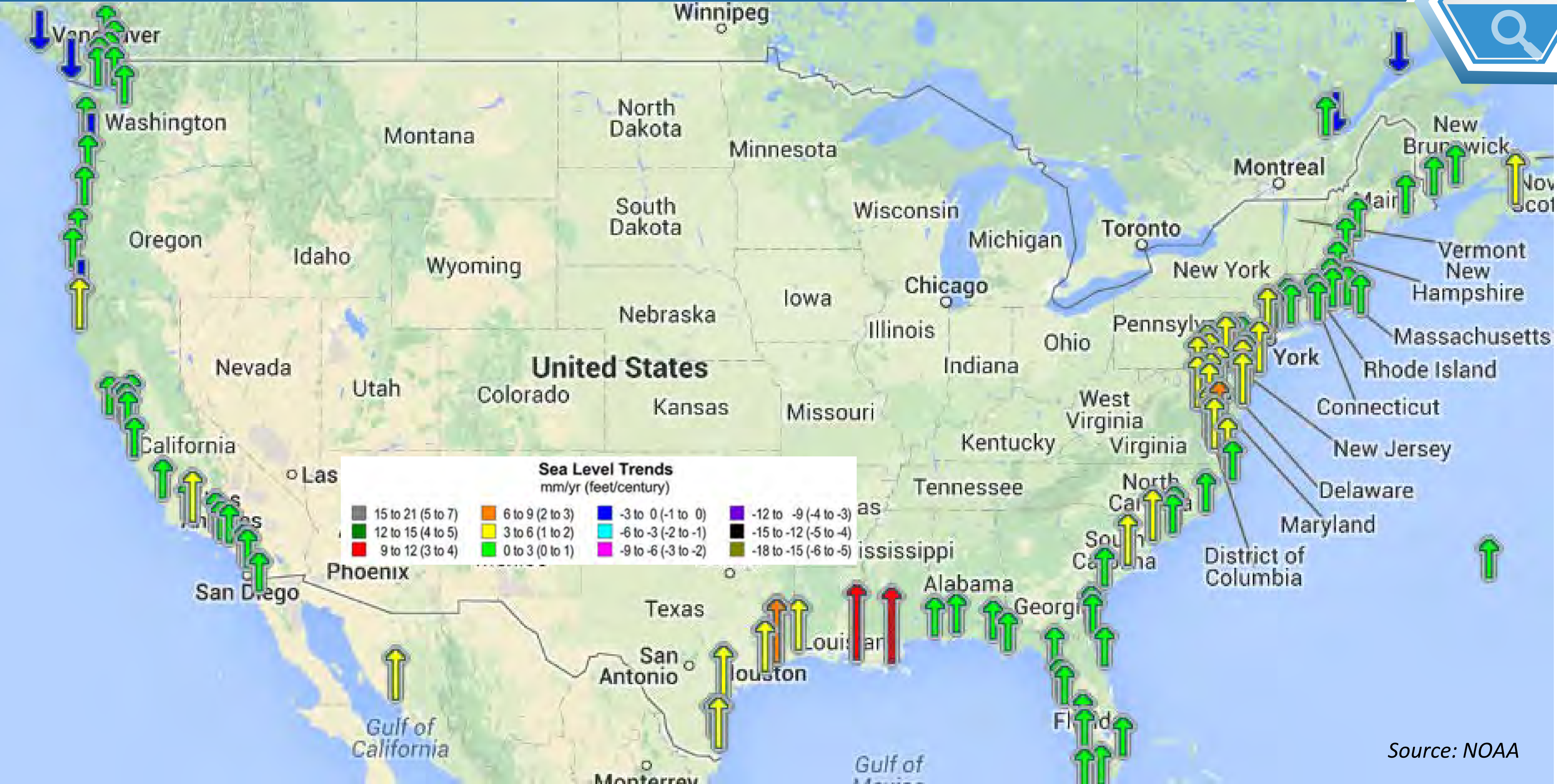
Identify

- Hazard Mitigation Plan
  - » Identifies climate-related natural hazards
  - » Quantifies how often observed past events happen and by location
  - » *May further provide information:*
    - – *Potentially vulnerabilities in your system*
    - – *Future changes in climate*
- Recent Events
  - » NOAA Storm Event Database
  - » Recent experiences
- Future Conditions
  - » National, state, and local reports
  - » Online resources (e.g., climate.gov)

- » Severe winter storms
- » Severe winds
- » Tornadoes
- » Extreme temperatures
- » Ice / sleet storms
- » Freeze-thaw days
- » Dust storms
- » Warming temperature
- » Drought
- » Wildfires
- » Coastal flooding
- » Inland flooding
- » Dam failures
- » Subsidence
- » Landslides, mudslides, and rockfalls
- » Tropical storms and hurricanes
- » Permafrost thaw

TRENDS NOW: Relative Sea Level Rise

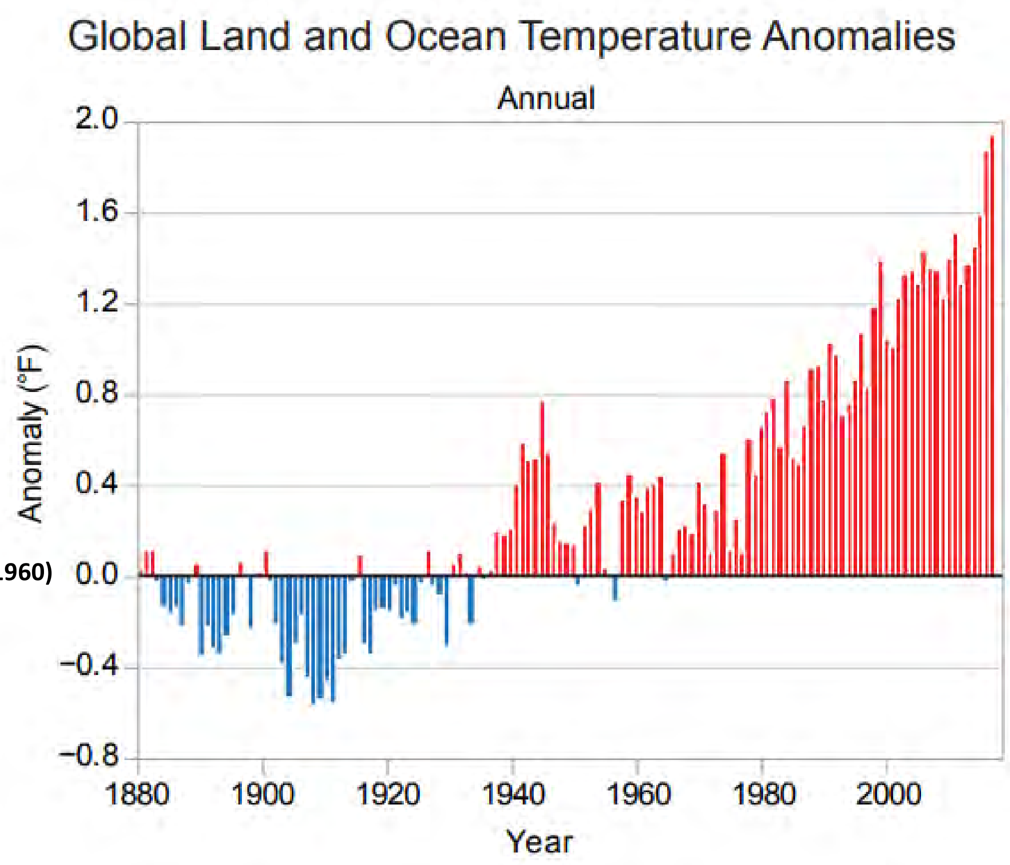
Identify



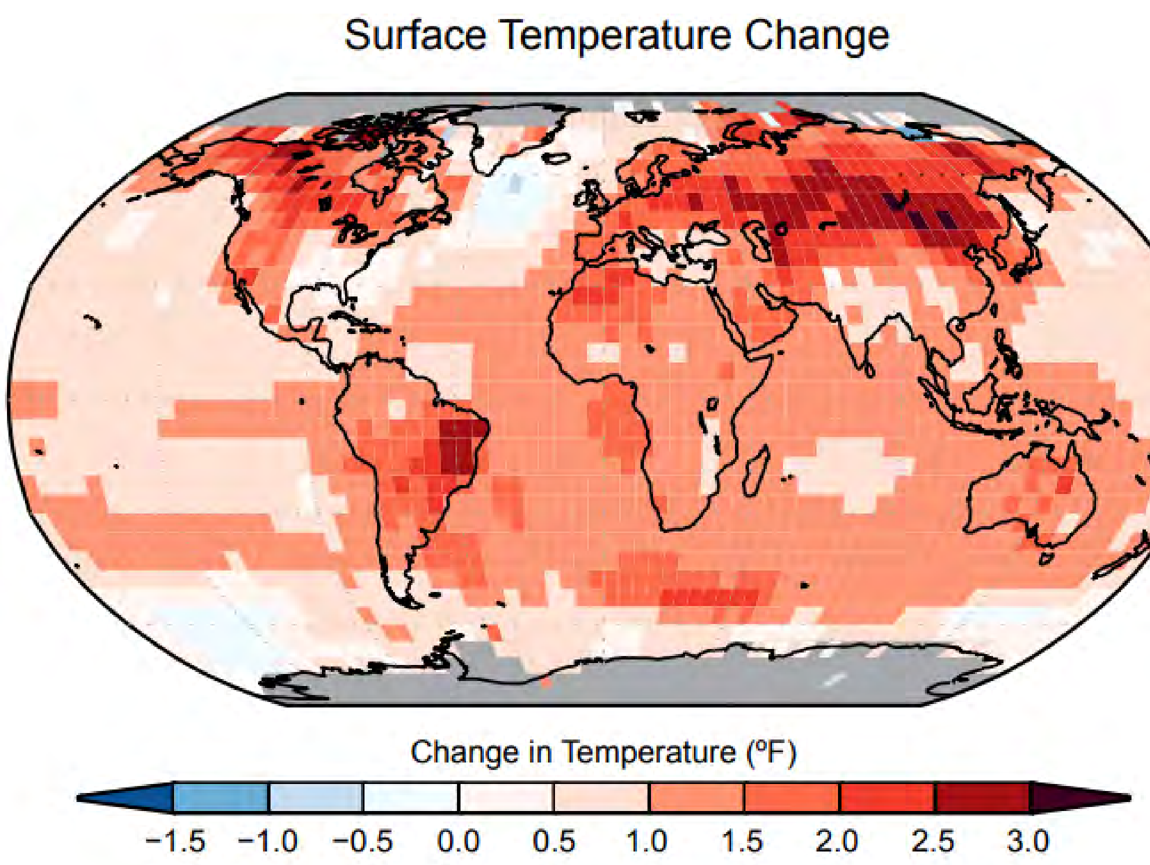
Source: NOAA

TRENDS NOW: Observed Temperature

Identify



(1901–1960)



1986–2016 relative to 1901–1960

USGCRP 2017

Leading To Changes In

Identify

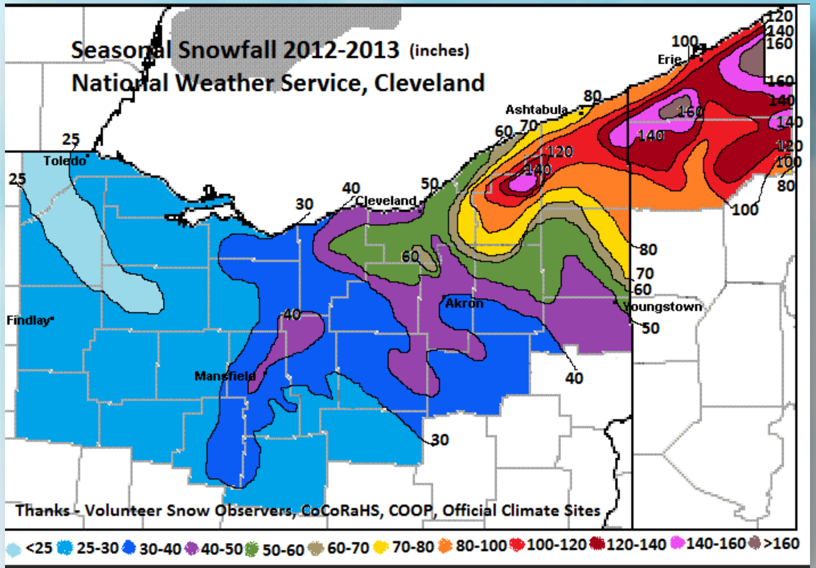
- Heavy precipitation
- Extreme heat
- Underground coastal inundation

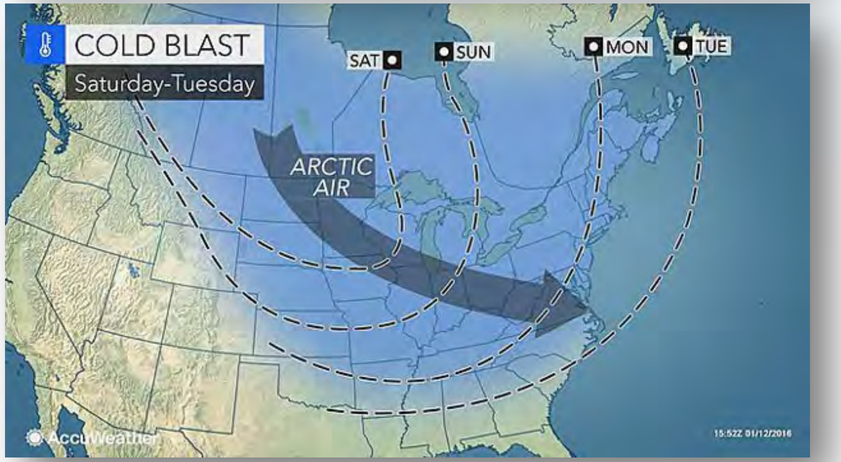
- Increased drought
- Less snow and more rain
- Storm intensification

- Flooding
- Sea level rise and erosion
- Changes in freeze/ thaw cycles

Ohio & Varying Weather Extremes

- Warm, humid summers and cold winters
- Locations near Lake Erie
  - Warmer in winter / cooler in summer
  - Lake effect snow
- Without large mountain barriers, no blocking mechanisms against:
  - Very cold air masses from the Arctic in the winter
  - Warm and humid air masses from the Gulf of Mexico in the summer

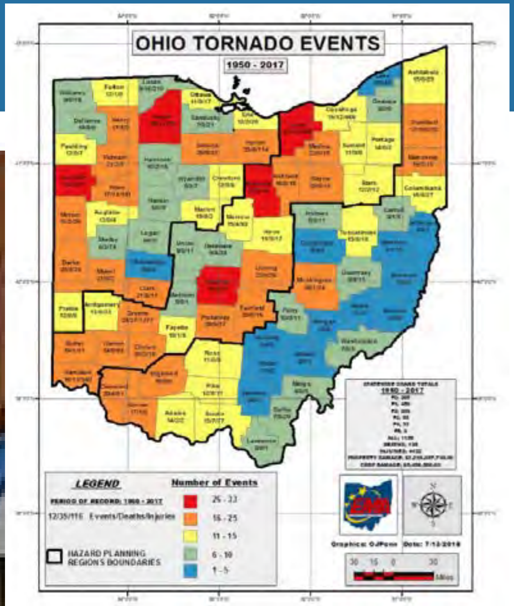


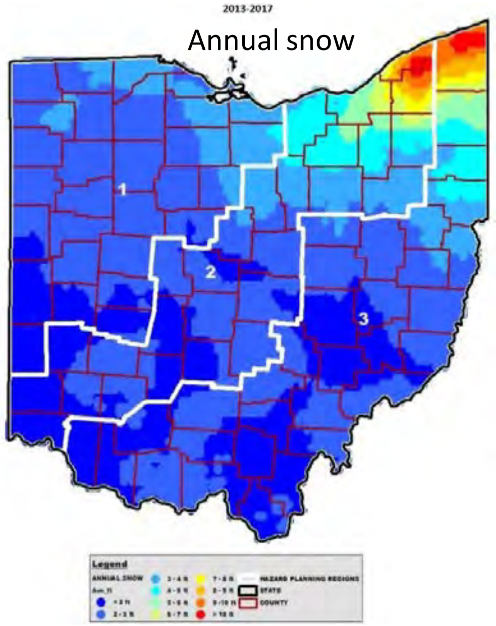


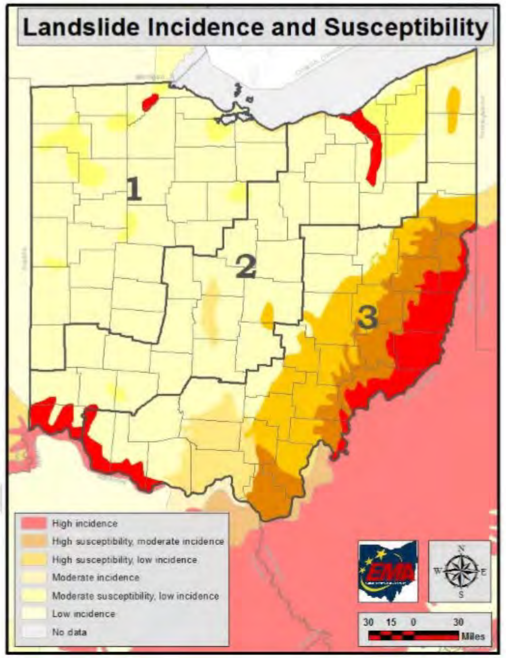
State's Top Ten Hazards of Concern

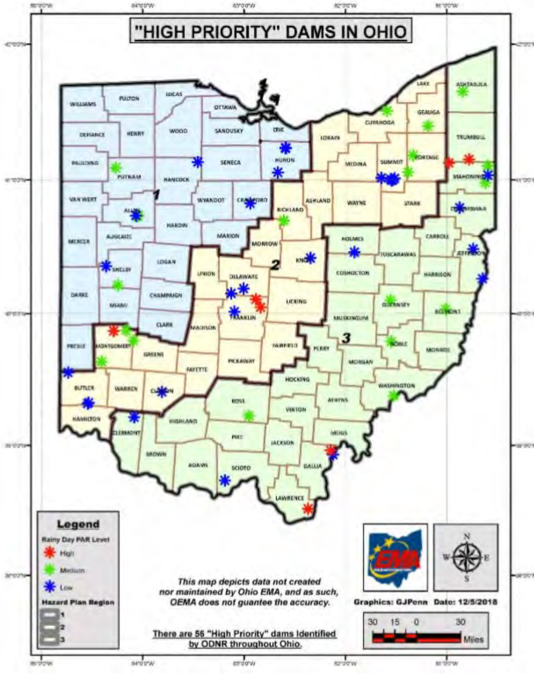
Overall Hazard Ranking		
Hazard	**Score**	**Rank**
Flooding	21.09	1
Winter Storms	20.54	2
Severe Summer Storms	18.44	3
Tornado	18.04	4
Drought	16.91	5
Earthquake	15.67	6
Dam/Levee Failure	14.71	7
Invasive Species	12.02	8
Landslide	11.97	9
Land subsidence	11.97	10
Wildfire	11.21	11
Coastal Erosion	10.39	12

Shelby flooding, 2011



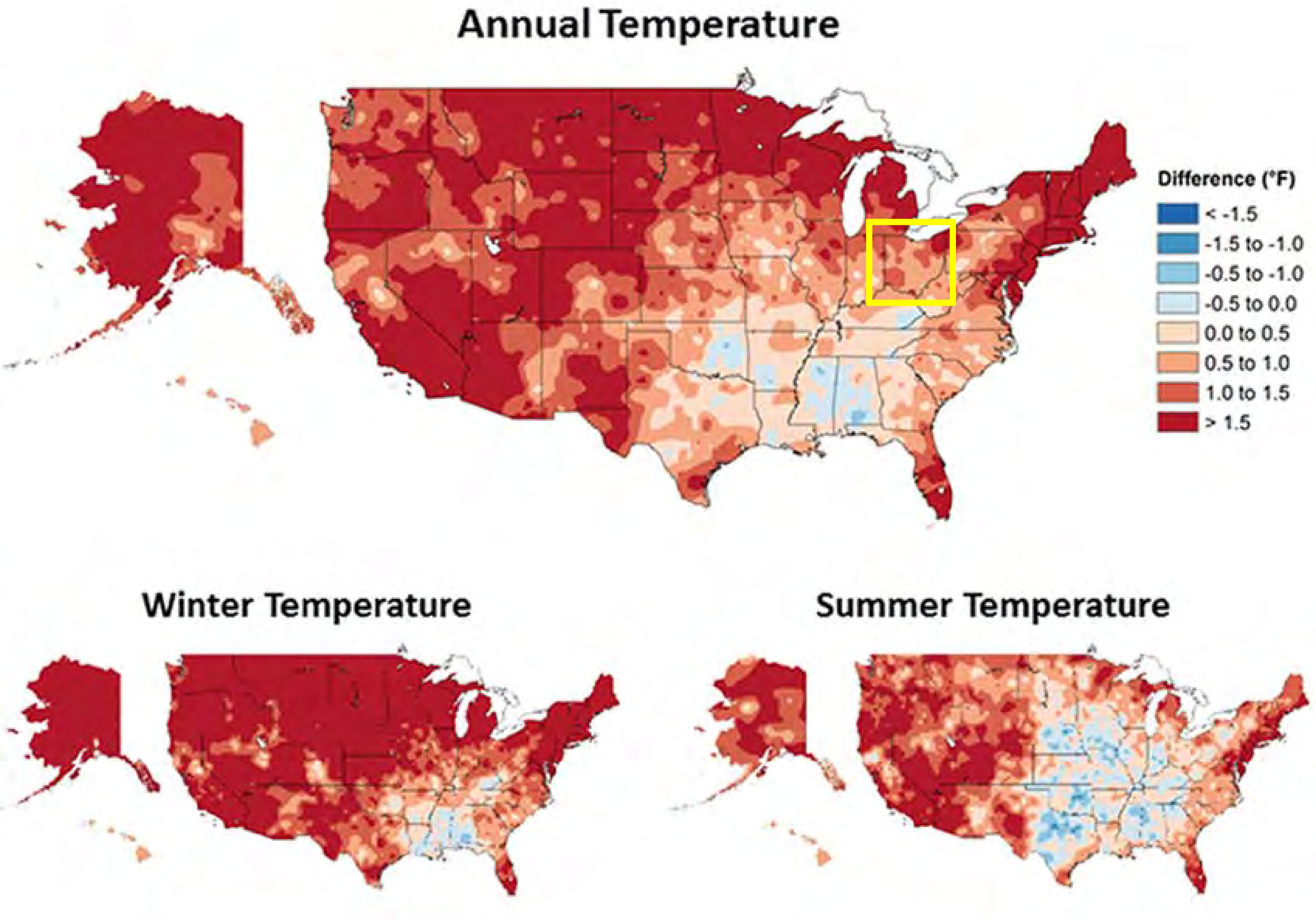






Source: State of Ohio Enhanced Hazard Mitigation Draft Plan (2019)

Recent Changes in Observed Temperature



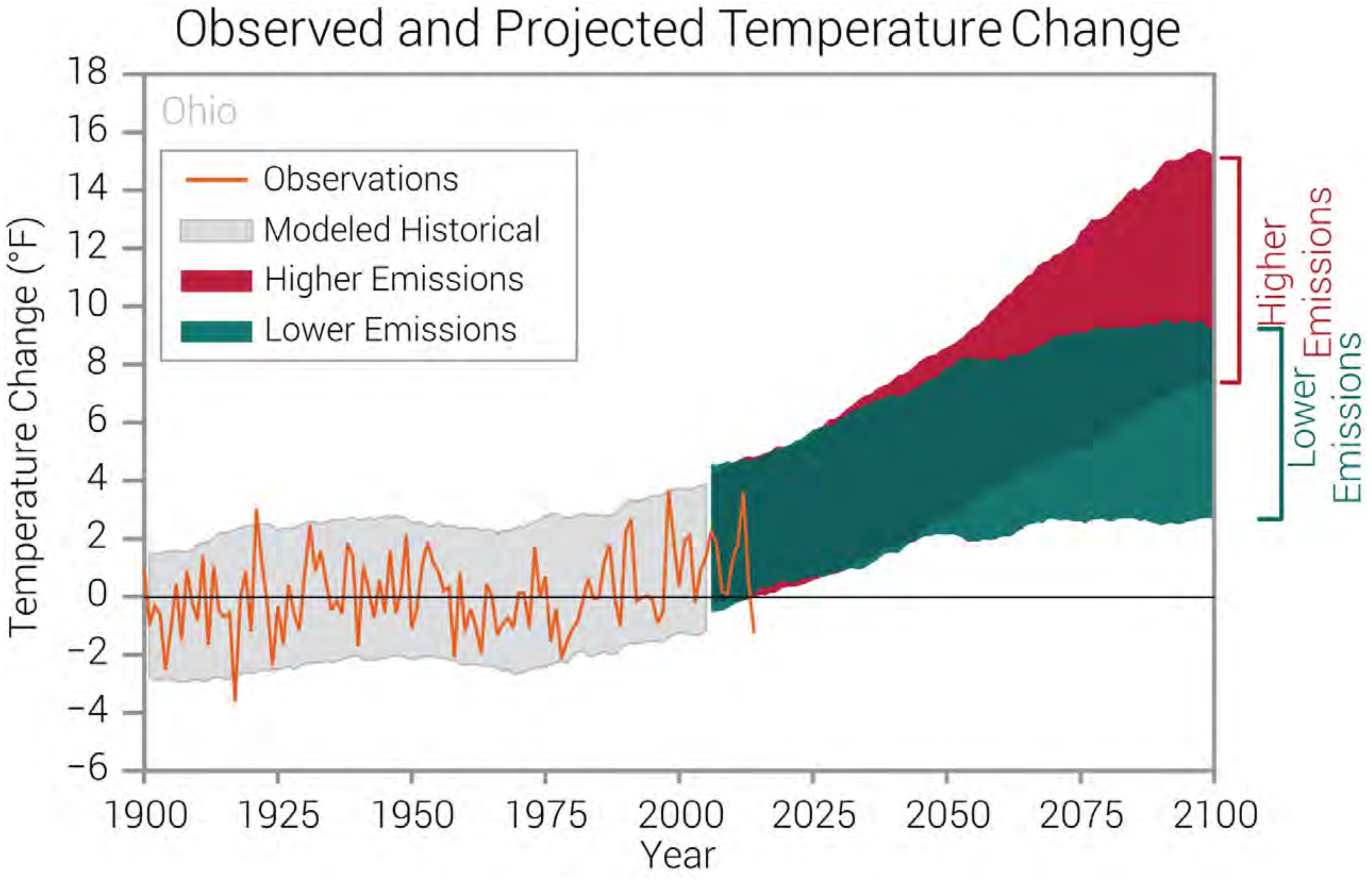
For Ohio:

- Annual temperatures have risen from 0.5°F to greater than 1.5°F rise across the state

- Greater temperature rise during winter months than summer

Source: NOAA/ NCEI

Ohio’s Changing Temperatures



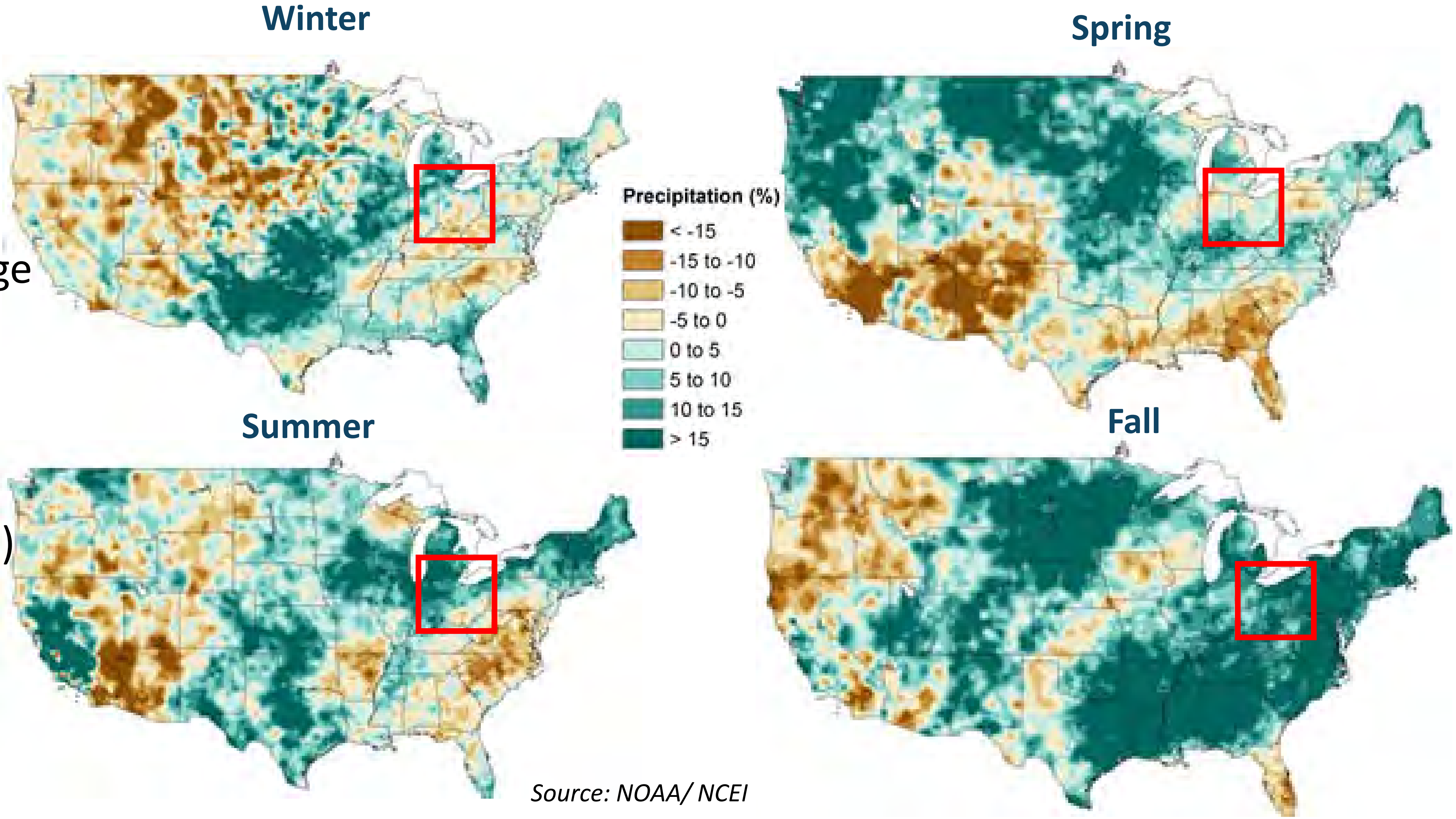
Source: CICS-NC and NOAA NCEI

- Rise of about 1°F since the beginning of the 20th century but not a steady rise (orange line)
- Increase in warmer nights (temps above 70°F), statistically significant warming in Cleveland and Columbus
- By mid-century, temperatures are projected to exceed historical record levels
- By end of century, annual average temperatures may rise an additional 2 to 14°F

Recent Changes in Seasonal Precipitation

For Ohio:

- Observed change in precipitation depends where you live (except Fall, wetter across the state)



Source: NOAA/ NCEI

Projected Changes in Seasonal Precipitation

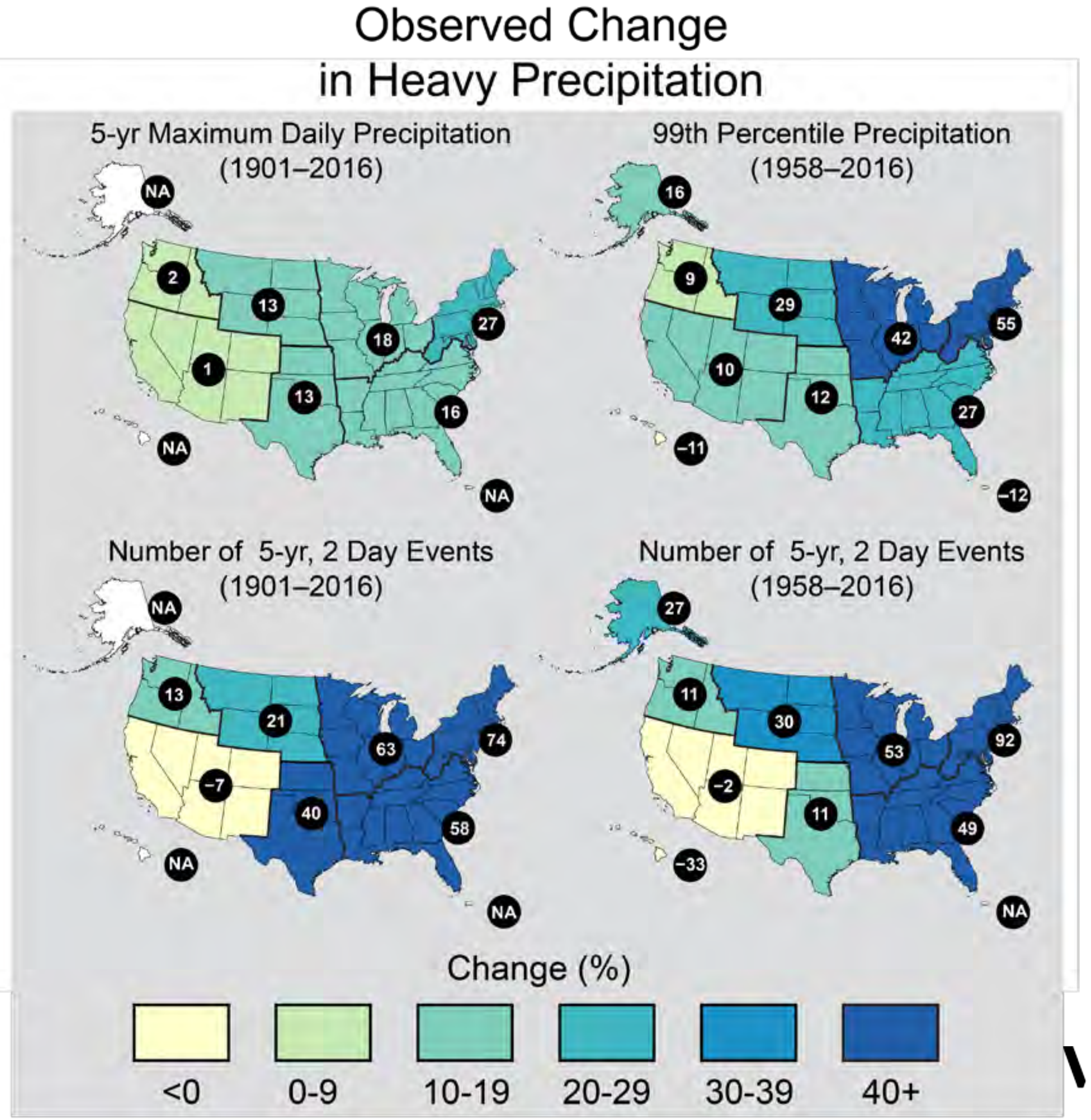
- Winter and Spring precipitation increase - 10-20% by 2100, high scenario
- Summer precipitation is projected to decrease - up to 10% by 2100, high scenario
- Intensity of future summer droughts projected to increase

Source: CICS-NC and NOAA/ NCEI

Recent Changes in Precipitation Events

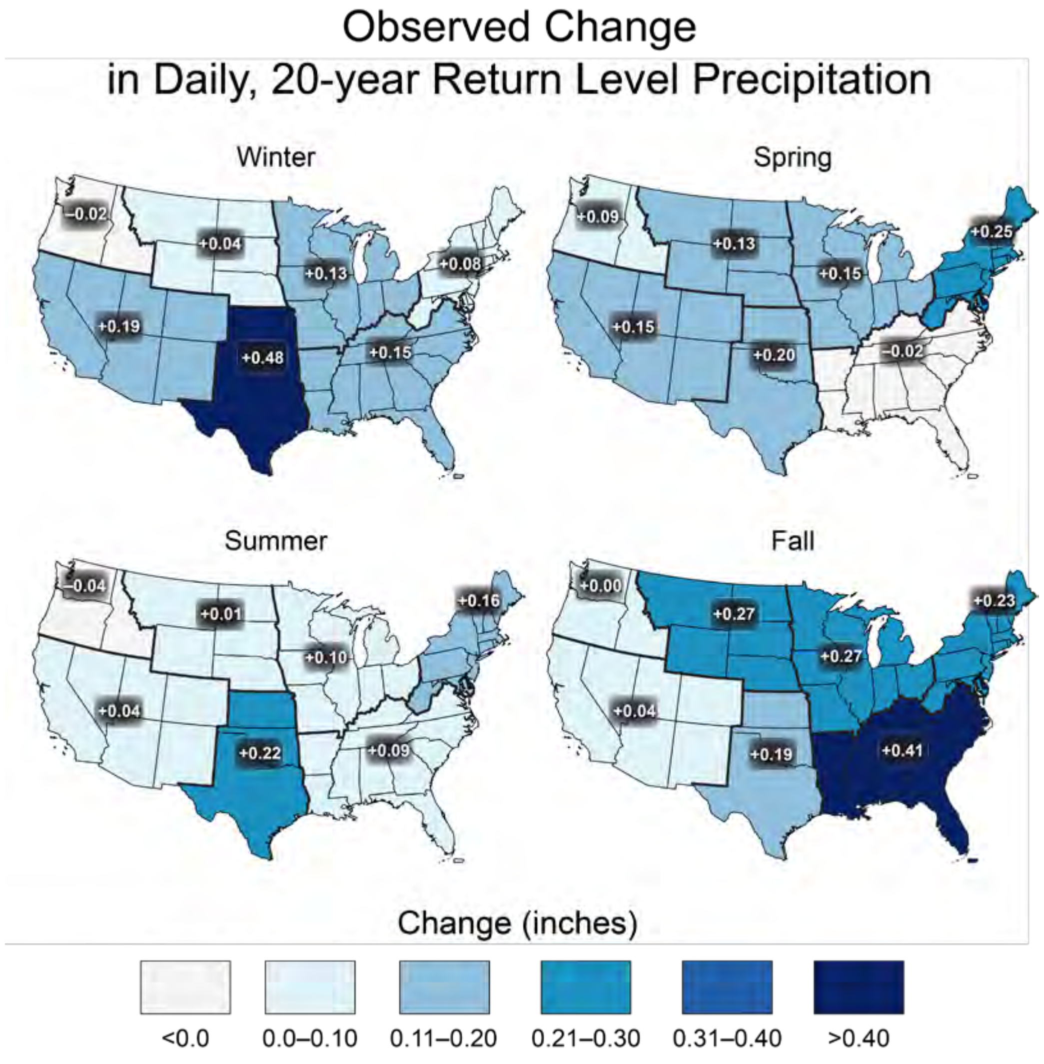
For Ohio:

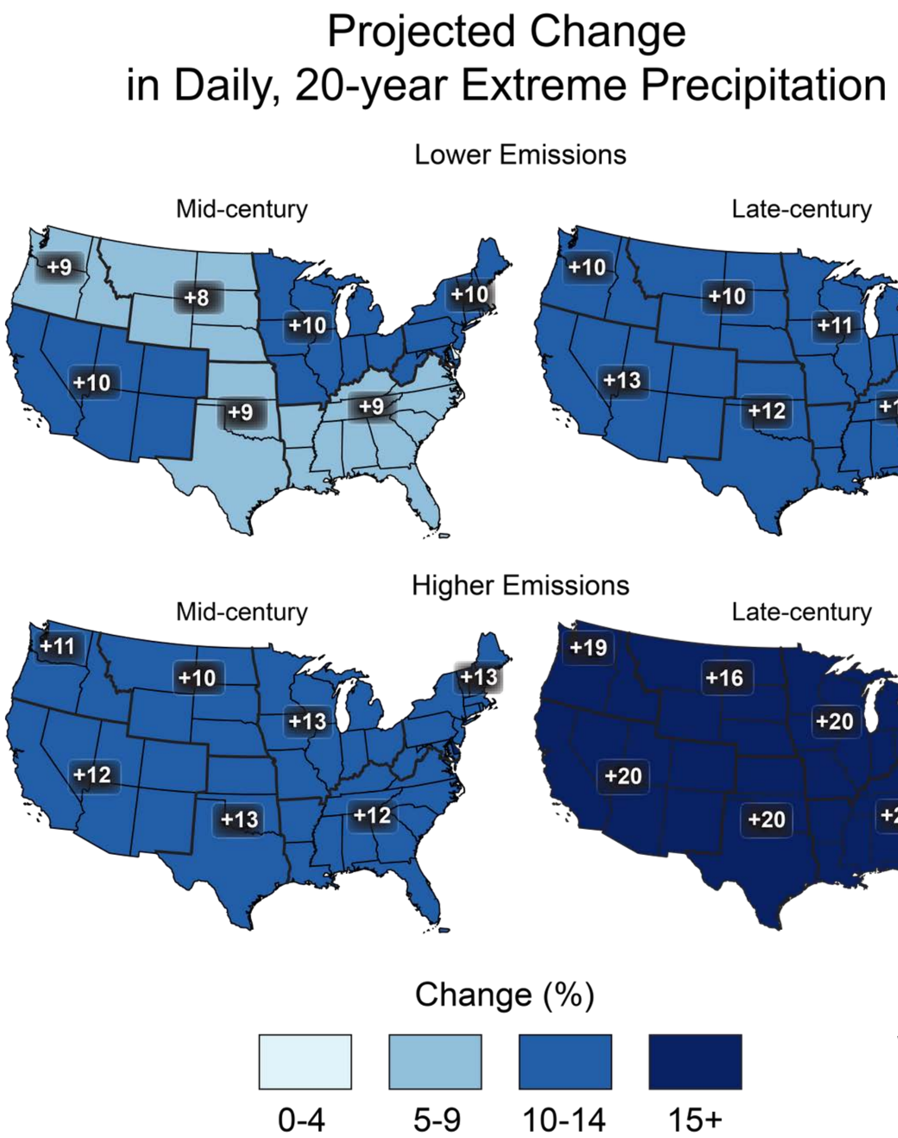
- 18% increase in Maximum Daily Precipitation
- 42% increase in 99th Percentile in Daily Precipitation
- 63% increase in 2 day events expected to occur every 5 years over the entire observation record
- 53% increase in 2 day events expected to occur every 5 years since mid-century



Source: CICS-NC and NOAA/ NCEI

Events getting "wetter"





Source: NCA4

Top Concerns over the next few decades

- Continued increase in heavy precipitation leading to more flood events
- Increase in summertime droughts
- Rising temperatures and warmer nights

February 25, 2018 Ohio Flooding (I-270, Franklin County)
Ohio Department of Transportation

Heat, Changes in Precipitation, Storm Events, Coastal Flooding Impact…

Identify


Life & Property


Aviation


Maritime


Space Operations


Forests


Emergency Management


Commerce


Ports


Energy


Hydropower


Reservoir Control

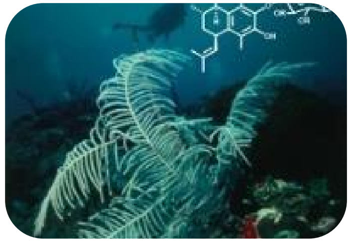

Infrastructure


Construction


Agriculture


Recreation

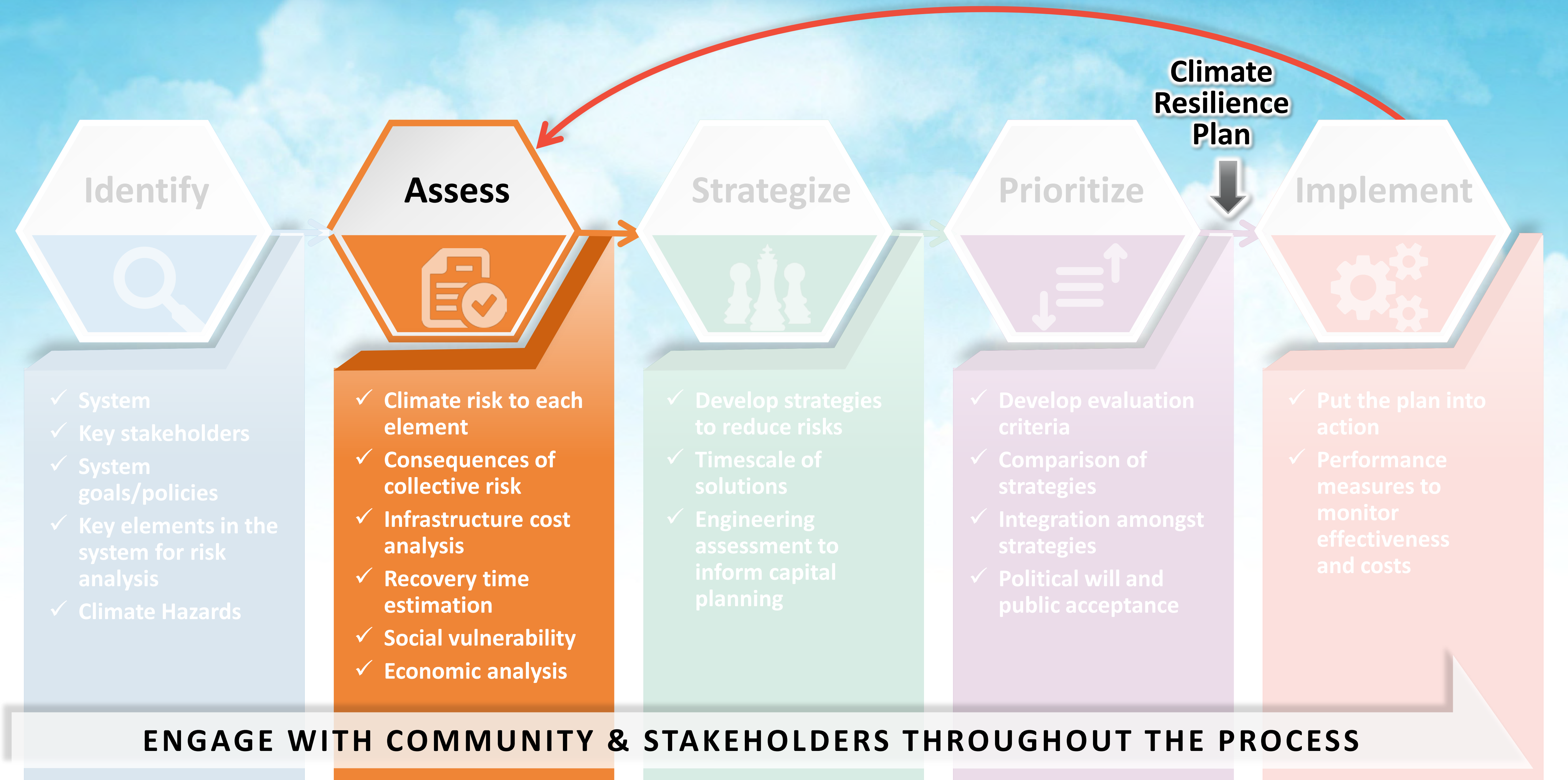

Ecosystems


Health


Environment

wsp

Methodology to Inform an Effective Climate Resilience Plan



Assessing from a Risk Perspective

Assess

Why Risk-based? Allows for informed decision making on investment decisions and project prioritization under future uncertainties...

Likelihood of the Hazard × System Vulnerability × Consequences = RISK

Climate Hazards and System Vulnerabilities

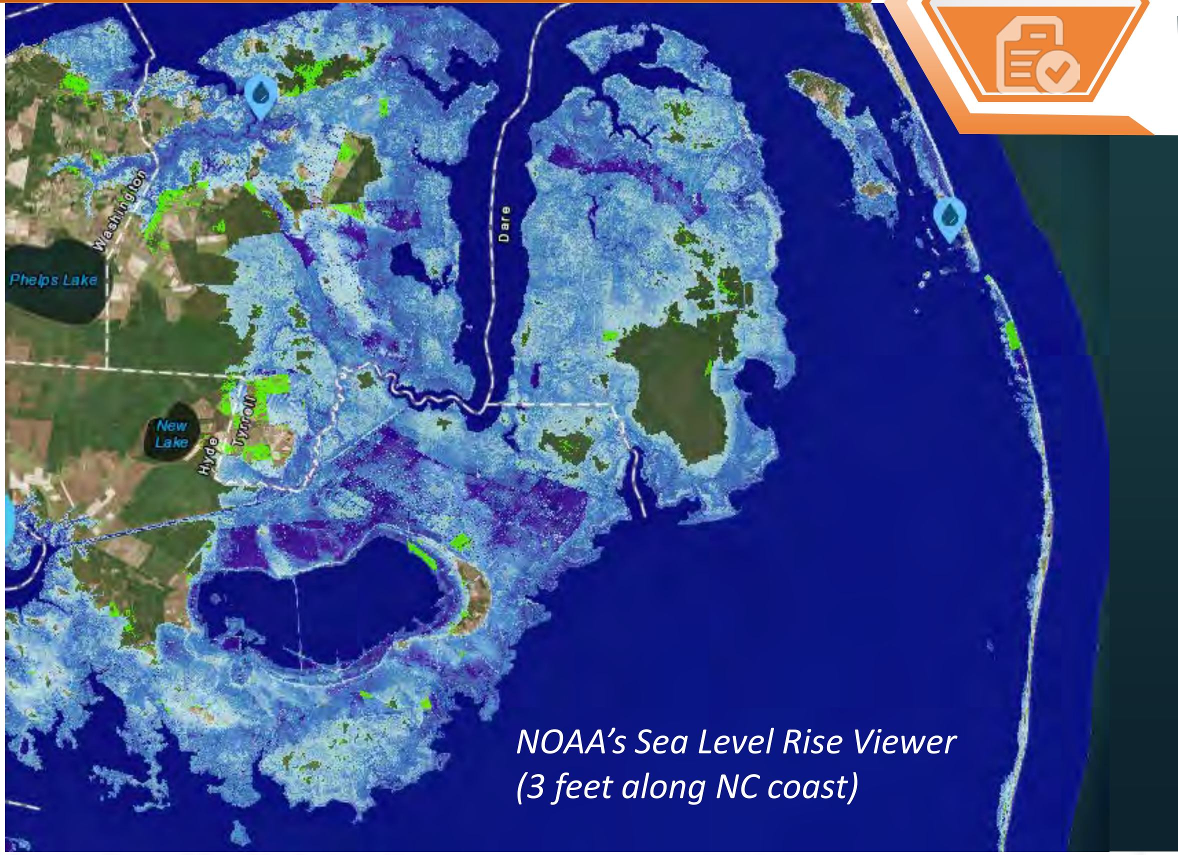
Assess

Hazards of Concern Now

- Discussion with stakeholders of past events (anecdotal evidence) and any notable trends in impacts over the past few decades
- Recorded costs and/or loss of operation associated with past events
- Drawing from analysis conducted at similar organizations

Hazards that could Impact the System

- Design standards (if values are surpassed)
- Published depth/damage, fragility curves, etc.
- Published impact information (e.g., mortality rates)



NOAA's Sea Level Rise Viewer (3 feet along NC coast)

Plain/Portland Concrete Road Stage Damage (London CC, 2011)

Depth (m)	Damage (%)	Explanation
-0.05	0	Very slight damage
0	0	Presume there is no damage to the surface layer until water level is above paved elevation
1	0.05	Including slight damage due to water on asphalt surface
2	0.1	Higher degree due to floodwaters inundating paved surface
5	0.25	Upper boundary of road damage

* references made to elev'n of road surface; anything below which is assigned a (-)ve value and anything above the datum (+)

Conceptual Diagram: Maritime Transport

Assess

Climate Drivers

- Changes in Precipitation
- Increased Temperatures

Hazards

- Drought

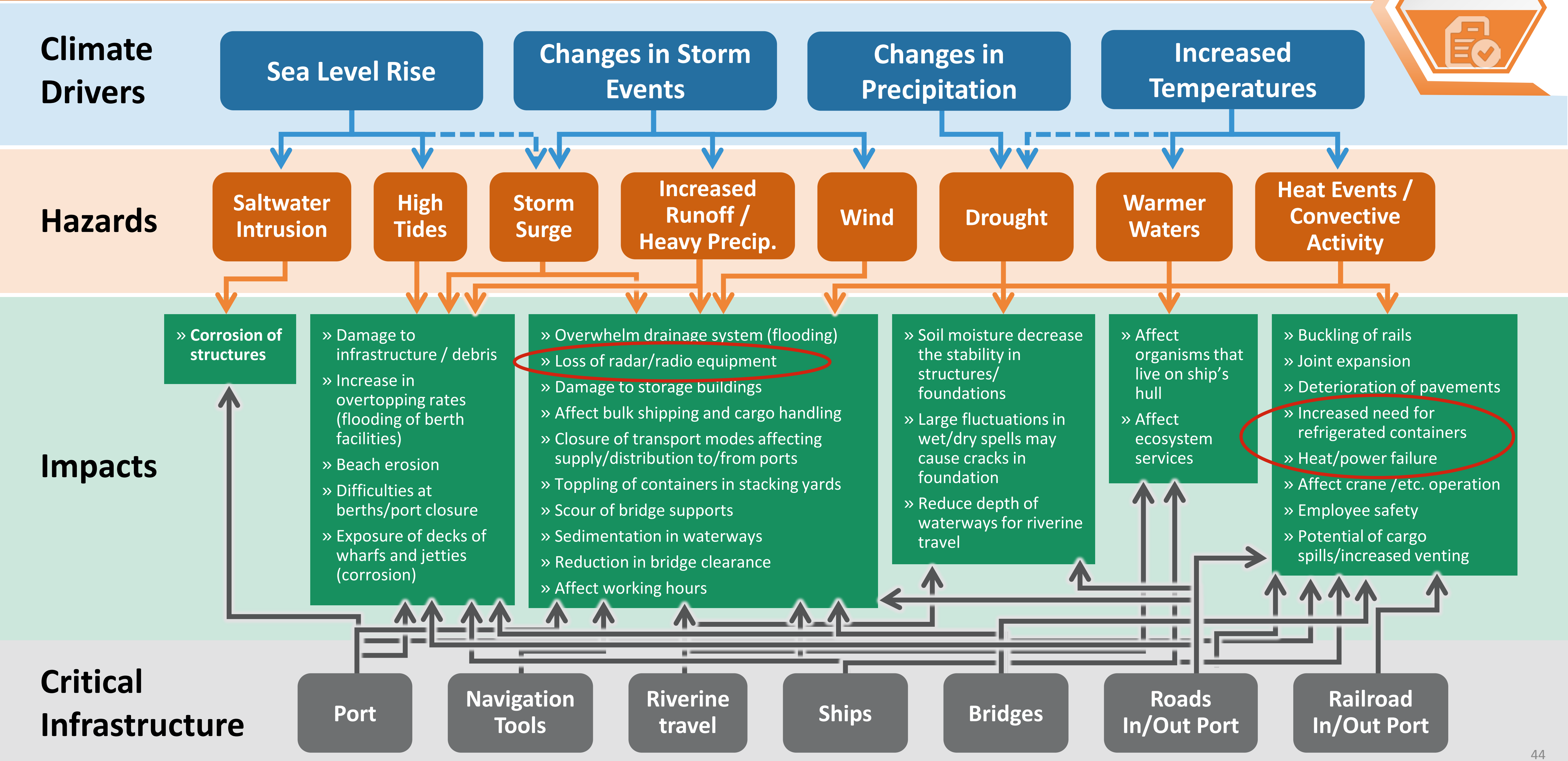
Impacts

- Soil moisture decrease the stability in structures/ foundations
- Large fluctuations in wet/dry spells may cause cracks in foundation
- Reduce depth of waterways for riverine travel

Critical Infrastructure

- Riverine Travel
- Roads In/ Out Port

Conceptual Diagram: Maritime Transport



Infrastructure Costs and Recovery

Relate level of damage to climate hazard

» Estimate costs of repair or rebuild
» Estimate recovery time

Consequences

Social Impacts

- » Disproportionate number of disadvantaged populations affected (using the building stock as a proxy of impact)
- » Percent of population and disadvantaged populations being evacuated
- » Potential for mental stress, causalities, and mortality
- » Loss of cultural heritage

Economic Impacts

Event-driven

- » Physical damage costs (repairs and/or replacement to transportation, buildings, energy, water, septic tanks, vehicles)
- » Displacement costs of residents for extended period post event (e.g., loss wages, increased living expenses)
- » Relocation costs of residents that are in areas projected to be inundated (the implied social impacts of loss of community and heritage)
- » Loss of service operation (water, energy)
- » Lost productivity through business interruption
- » Number of flooded businesses based on building stock
- » Debris removal costs

Long-term

- » Reduction in property values based on event occurrence and increase in insurance costs
- » Increase beach nourishment costs to maintain a “no action” scenario
- » Increase maintenance costs on sectors to maintain operation and services

Environmental Impacts

Event Driven

- » Impacts on water and air quality
- » Damage to ecosystem with migration or displacement of animals into population centers

Long Term

- » Loss of ecosystem services
- » Impacts on greenhouse gas emissions
- » Change in vegetation and the physiological effects on plants and insects

Quantification of Consequences

Assess

Translate into quantifiable physical, economic, and social impacts

PERCENT OR NUMBER OF THE population impacted

COST ASSOCIATED WITH DURATION OF OUTAGE for essential services

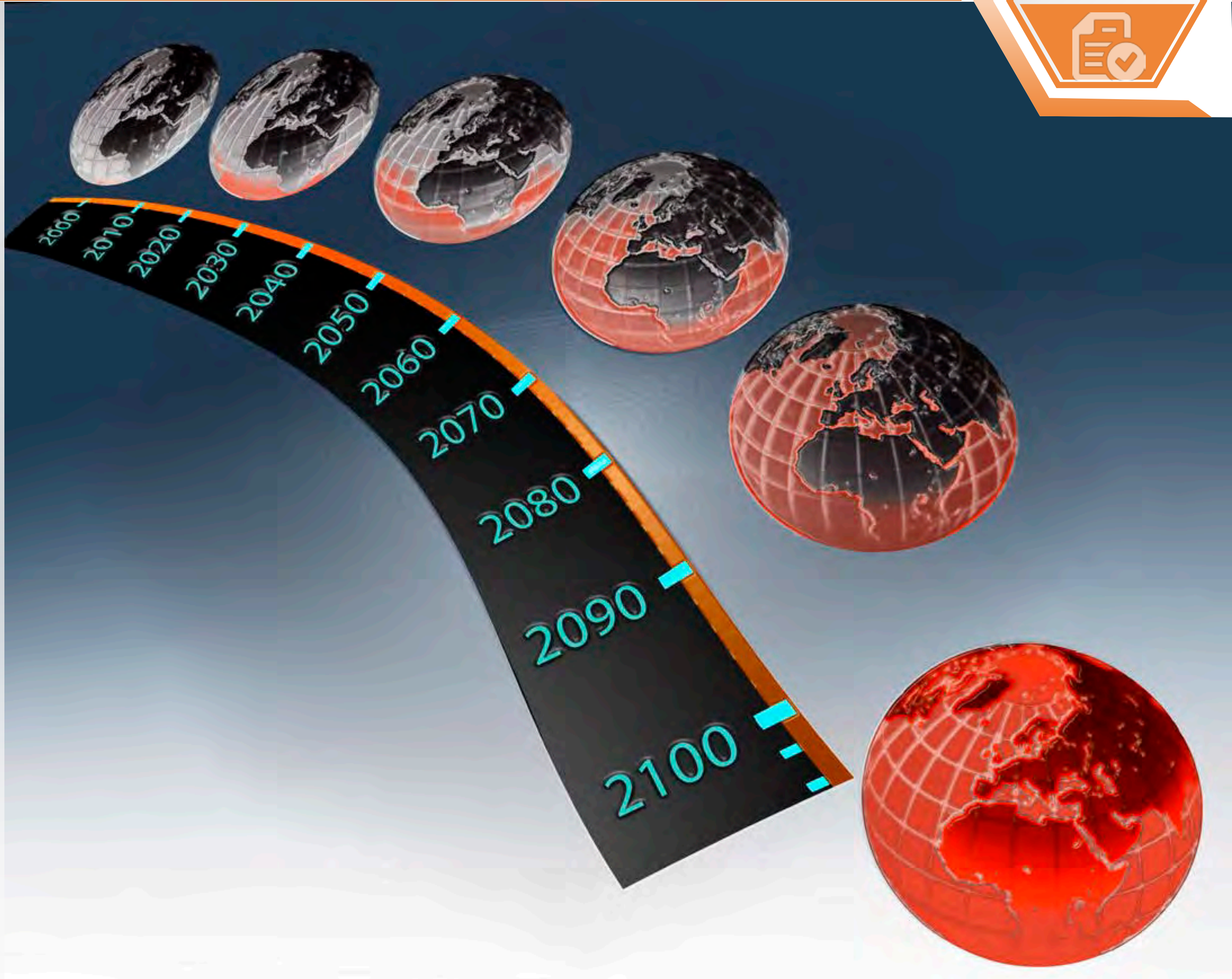
COSTS FOR POPULATION being displaced

NUMBER OF MORTALITIES associated with event

Assessing Future Climate Hazards

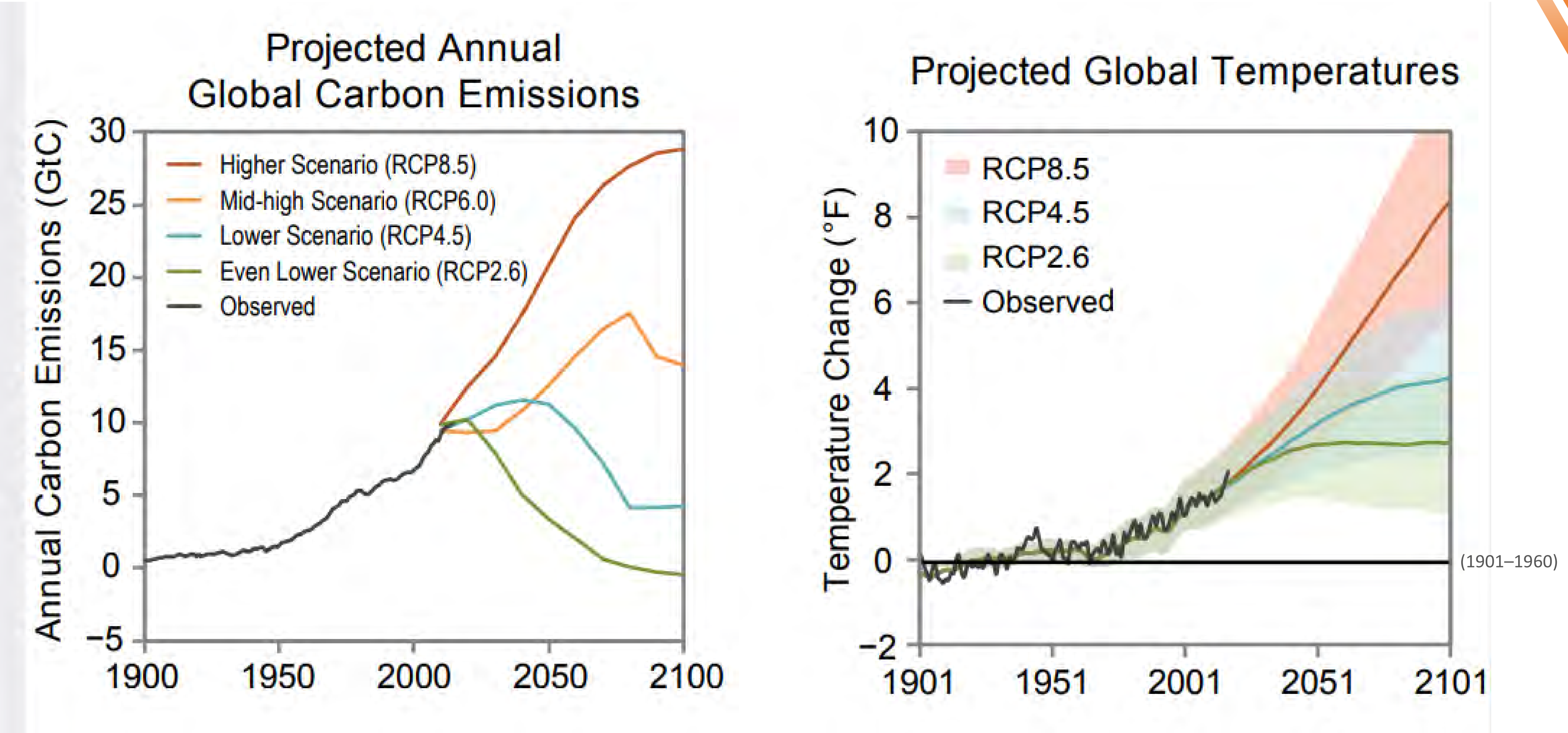
Assess

- Next, how will these risks change in the future
- Now assess how climate hazards may change in the future
  - » Recognizing there is inherent uncertainty in capturing future hazard exposure
  - » Results of change need to reflect this uncertainty



Global Warming by 2100 due to Heat-Trapping Gases

Assess

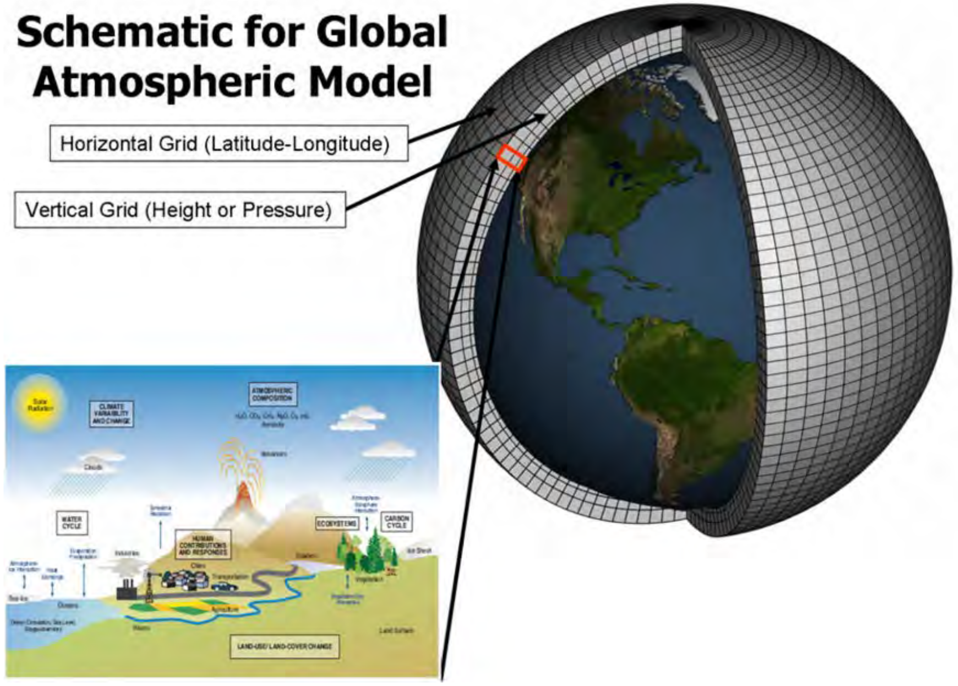


Stop emissions today, committed to additional rise ~1.1°F

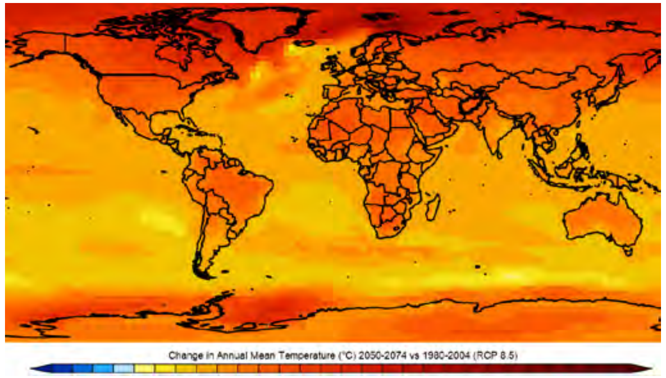
USGCRP 2017

Variability across Climate Models

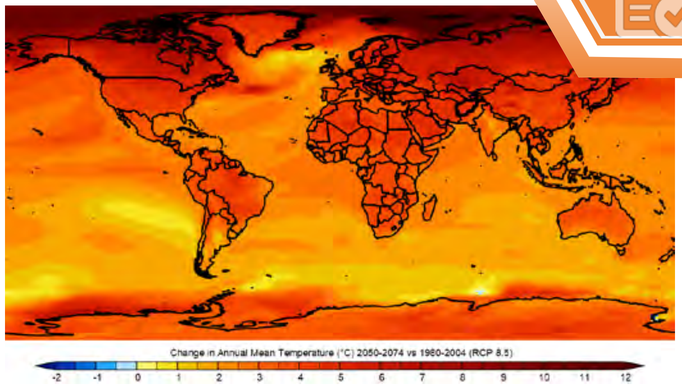
Assess



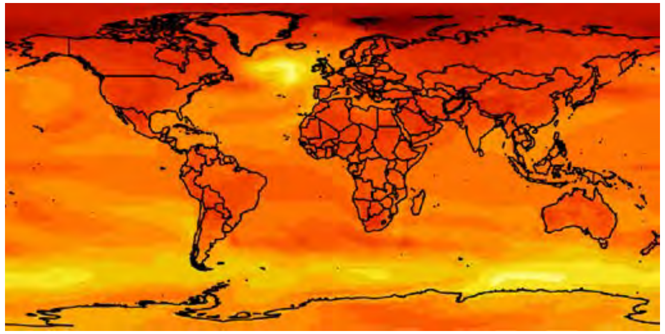
Source: NOAA GFDL; Alder et al. 2013



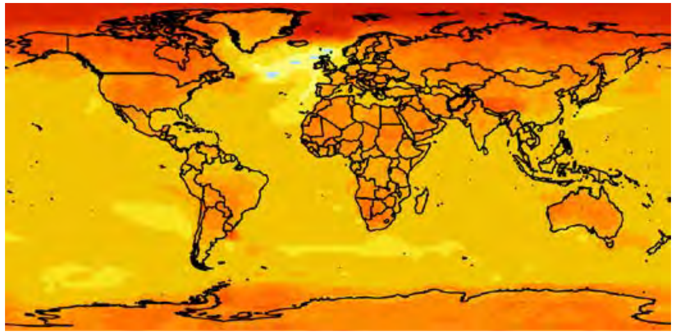
Mean



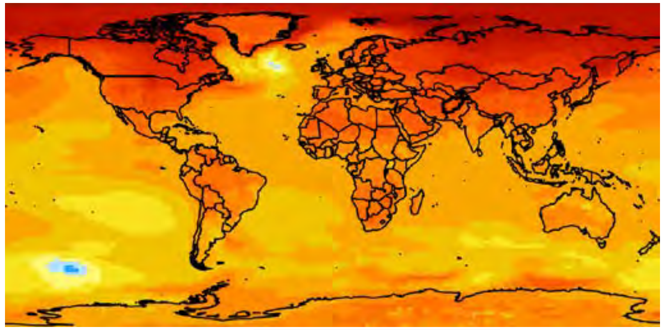
HadGEM2-CC



IPSL-CM5A-MR



inmcm4

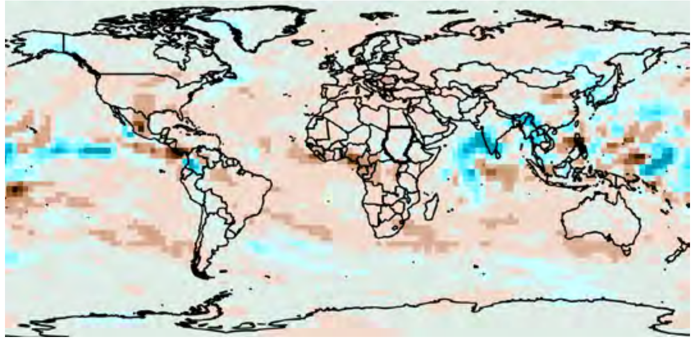


NorESM1-ME

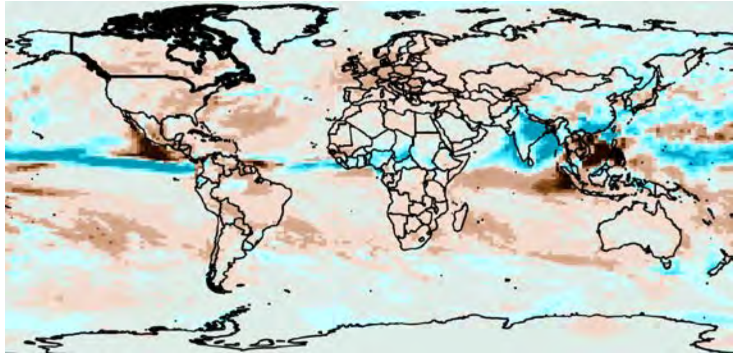
Change in Mean Annual Temperature
2050-2074 vs 1980-2004
RCP8.5

Variability across Climate Models

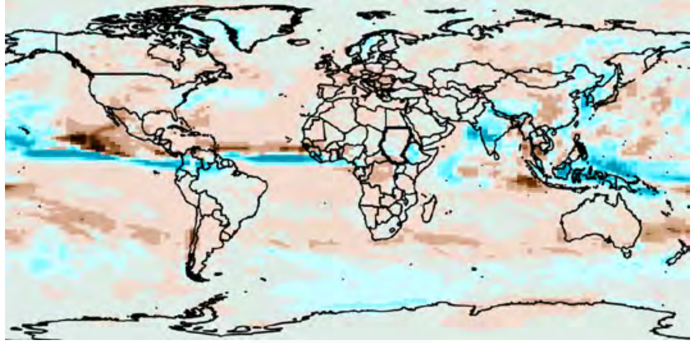
Assess



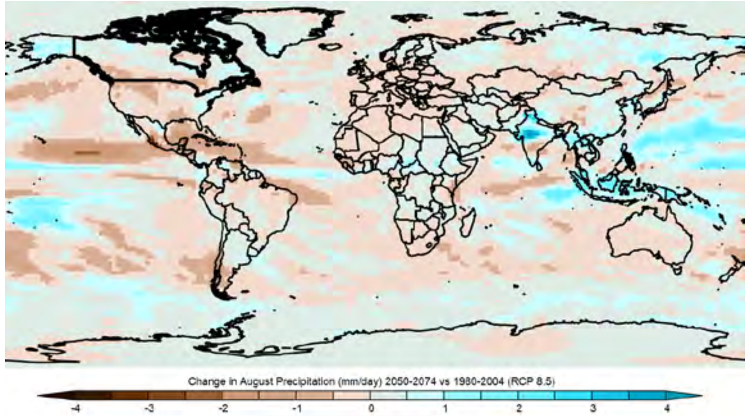
Mean



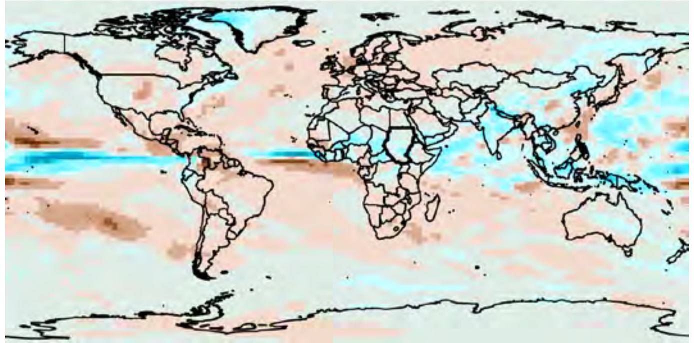
HadGEM2-CC



IPSL-CM5A-MR



inmcm4



NorESM1-ME

Confidence in Results

Less →	**More**
Precipitation	Temperature
Daily or Extreme	Annual/Monthly
Municipal-scale	Regional

Change in August Precipitation (mm/day)
2050-2074 vs 1980-2004
RCP8.5

Source: USGS CMIP5 Global Climate Change Viewer, Oregon State

Assess Climate Data

Assess

[NCA4 Climate Science Special Report]

[NOAA's Sea Level Rise Viewer]

- Regional, state, and/or local climate data processed
  - » Example, California Heat Assessment Tool
- It's important to utilize climate data tailored for your climate metrics
  - » Provide information on conditions may change to measure of harm/threat that has inherent uncertainty
- Analyze the data from a risk perspective:
  - » What is the future likelihood the thresholds will be met under a given scenario?

Communicate Climate Hazards to Non-technical Audiences

Assess

- Findings are easy to identify and understand
- Visuals are simple and consistent in shading
- Uncertainty and confidence is spelled-out

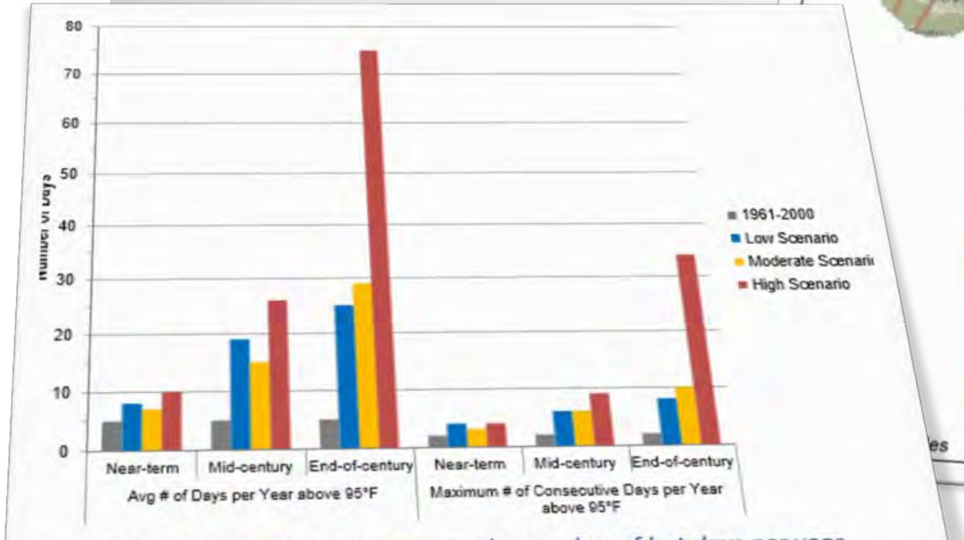
Key Findings

» Hot summer days with little relief in temperatures

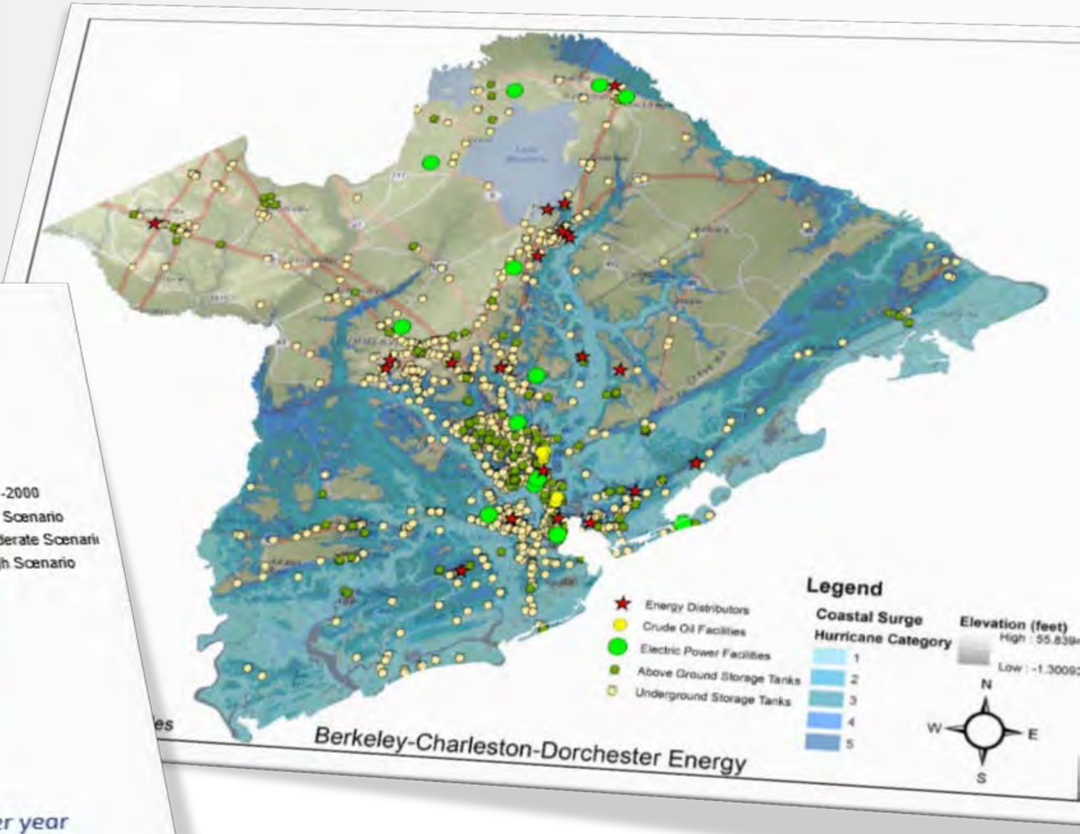
» Increased evaporation, particularly in the summer, potentially affecting water availability

» Increase in coastal flooding extent, frequency, and duration during high tide conditions

» Increase in storm surge inundation



This figure suggests an increase in the number of hot days per year and occurring in longer durations during the summer.



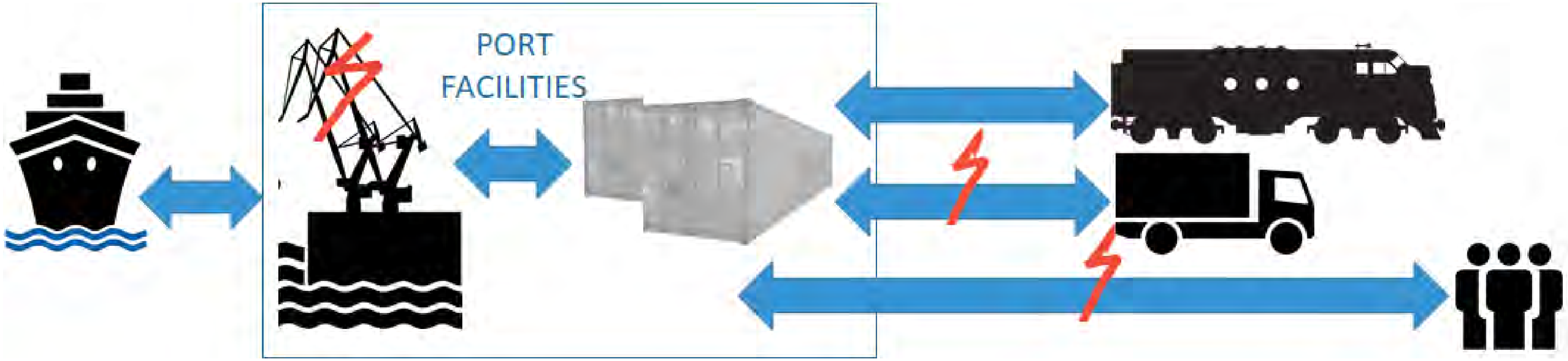
Future Consequences of Climate Vulnerabilities

Assess

Visualize using a GIS-platform

- Within a region, what services are potentially comprised?
- What's the collective impact on your system or community?

Develop a schematic and identify consequences



Assessing Social Vulnerability & Climate Change

Assess

Assess capacity to prepare for a flood or storm event

- » Evacuation communication
- » Access to evacuation routes
- » Ability to be mobile
- » Access to shelters

Assess capacity to deal with immediate damage

- » Access to food
- » Access to shelter
- » Access to medical attention
- » Ability to be mobile

Recovery & Mitigation*

- » Financial stability
- » Health & wellbeing
- » Ability to be mobile
- » Continued access to employment

PREPAREDNESS

RESPONSE

RECOVERY & MITIGATION*

Assessing consequences to socially vulnerable populations

Assess

Here again, you can develop a schematic or community map and identify consequences

Key Resources to Identify Socially Vulnerable Populations

- ✓ Community census data
- ✓ Stakeholder & public engagement meetings
- ✓ Historical and contemporary narratives
- ✓ Interviews

Government building flooded → **Services suspended** → **Individuals potentially cannot access:**
- SNAP benefits
- Free health clinics

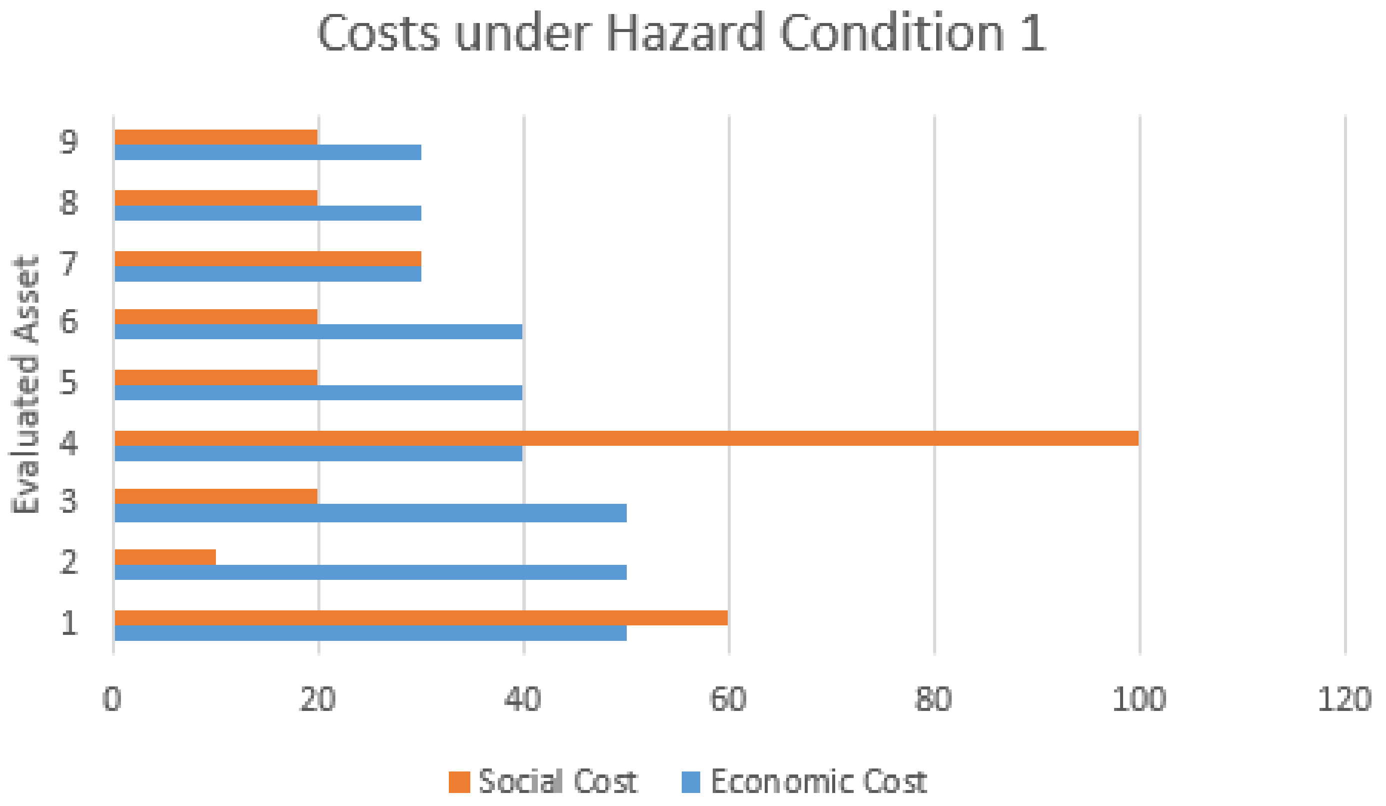
→ **Results in community health impacts, mental stress, mortality.** → **Increased vulnerability & exacerbated impacts into the future**

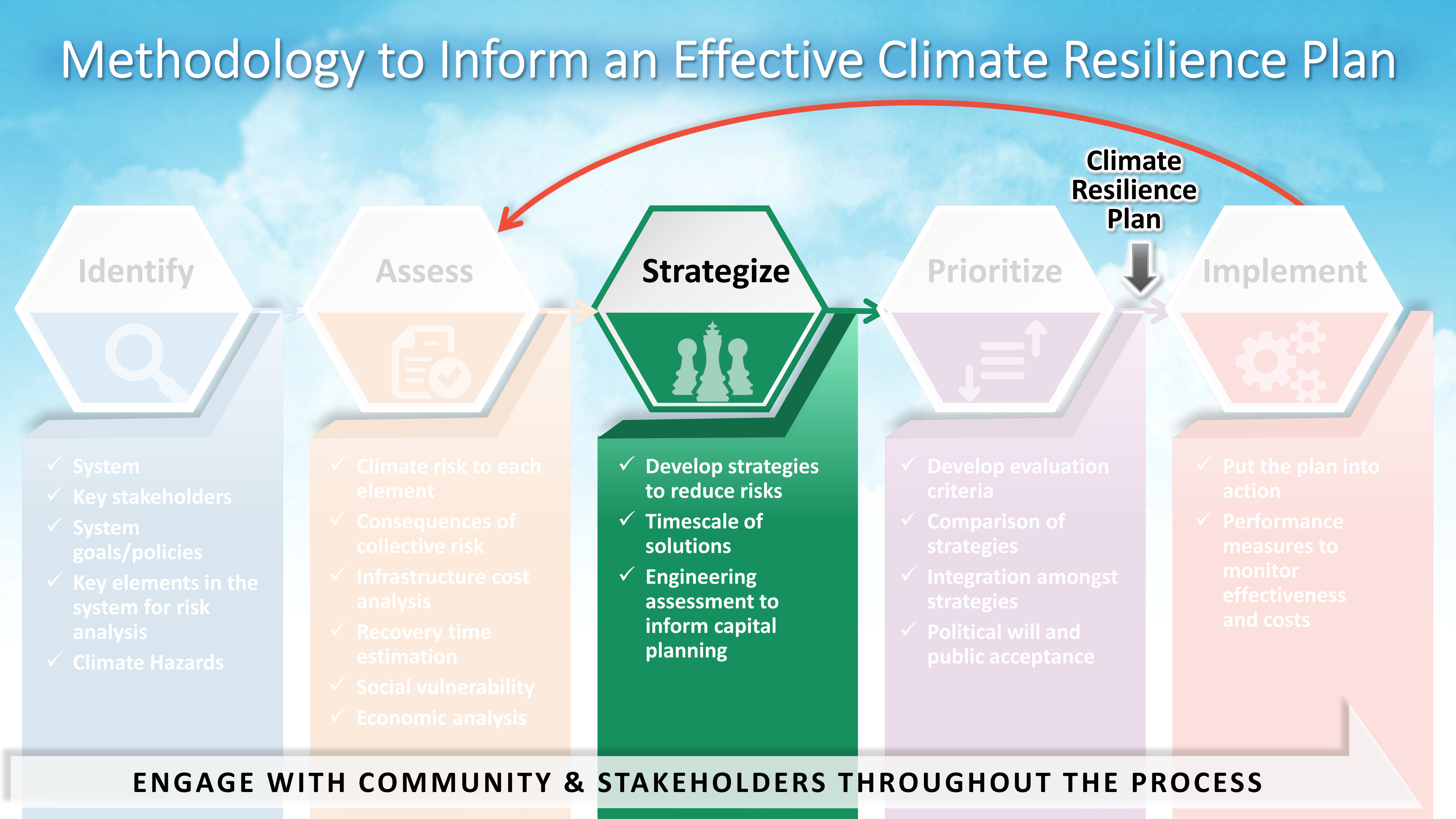
wsp

Evaluate and Determine Top Risks

Assess

- Review the assessment findings
  - » Rank based on what matters most to you (consistent with vision/goals)
    - – Costs and economic impacts
    - – Population / employees impacts
    - – Services for the community impacts
    - – Level of disruption to business continuity
    - – Impacts on supply chain
    - – Reputation
    - – Environmental impacts




Methodology to Inform an Effective Climate Resilience Plan
Climate Resilience Plan
Identify
Assess
Strategize
Prioritize
Implement
✓ System
✓ Key stakeholders
✓ System goals/policies
✓ Key elements in the system for risk analysis
✓ Climate Hazards
✓ Climate risk to each element
✓ Consequences of collective risk
✓ Infrastructure cost analysis
✓ Recovery time estimation
✓ Social vulnerability
✓ Economic analysis
✓ Develop strategies to reduce risks
✓ Timescale of solutions
✓ Engineering assessment to inform capital planning
✓ Develop evaluation criteria
✓ Comparison of strategies
✓ Integration amongst strategies
✓ Political will and public acceptance
✓ Put the plan into action
✓ Performance measures to monitor effectiveness and costs
ENGAGE WITH COMMUNITY & STAKEHOLDERS THROUGHOUT THE PROCESS

Risk Assessment then Informs Strategies

Strategize

Example Strategies:

- Evaluate and upgrade all facilities and infrastructure identified at risk
- Consider measures for strengthening "weak links“ in the supply chain
- Incorporate climate risk into future project design and location selection
- Hazard-proof new facilities and infrastructure
- Expand employee or community safety plans

Strategy No.	Strategies for Power Plant / SLR	Description	Relative Costs ($-$$$)	Level of protection (0-3)
Flood Protection				
E.1	Flood proof/flood-resilient stations	Combination of structural and non-structural modifications to power stations to reduce or eliminate flood damage. - Dry flood-proofing, including flood shields, water tight doors, installation of flood proof materials, seal exterior walls - Wet flood-proofing, including modifying structures to allow flood water to enter and exit	$$	2
E.2	Raise facility	Raise above flood depths of 3 to 4 feet	$$$	2
E.3	Move facility	Relocate facility from the pathway of future flood	$$$	3
E.4	Abandon facility	Close power plant (customers access energy available from another power plant within the system, assumes supply available)	$$$	0
E.5	Shift to submersible pumps	Submersible pumps are designed to operate underwater and provide greater resilience to flooding and potential high flood depths	$$	2
E.6	Install backflow prevention	Backflow prevention (gates, valves, duckbills) provides a protection against flood waters entering discharge pipelines or channels	$$$	2
E.7	Construct flood walls or levees	Block water with levees (earthern embankments) or walls (manmade structures) for the individual facility; (water will need to be redirected)	$$$	3
E.8	Sandbag critical pathways	Accessible sandbags to provide protection to critical infrastructure, for either access to or protection of critical operational components	$	1
E.9	Build tidal barrier structure	Tidal barriers are structures that sit in the water that can be closed to prevent high tidal peaks	$$$	3

wsp

How to Craft Inclusive Resilience Strategies?

Strategize

1. Consider the feasibility of resilience strategies with respect to socially vulnerable communities:

Assess risk → Strategize → Who will be able to carry out the strategy?
Who will be left out the strategy?
Who will the strategy benefit?

Example: Elevating homes

- Restrictions to socially vulnerable populations:
  - Access to money
  - Property ownership

- Identify ways to mitigate these restrictions during strategy development.

How to Craft Inclusive Resilience Strategies?

Strategize

2. Consider the longer-term impacts the strategies might have

HEALTH

» Access to medical facilities

HOUSING

» Tax base
» Demographics
» Property values

Consider the web of basic needs and how these might change due to the selected strategies

JOBS & INCOME

» Key industries
» Access to employment

FOOD

» Access to food
» Agriculture

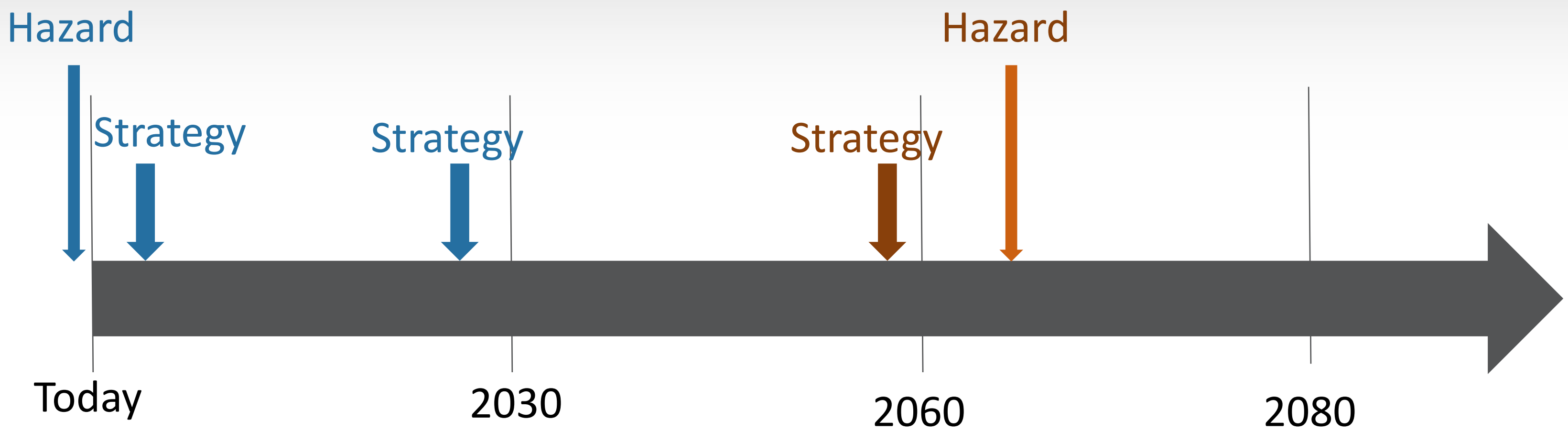
Timescale of Solutions

Strategize

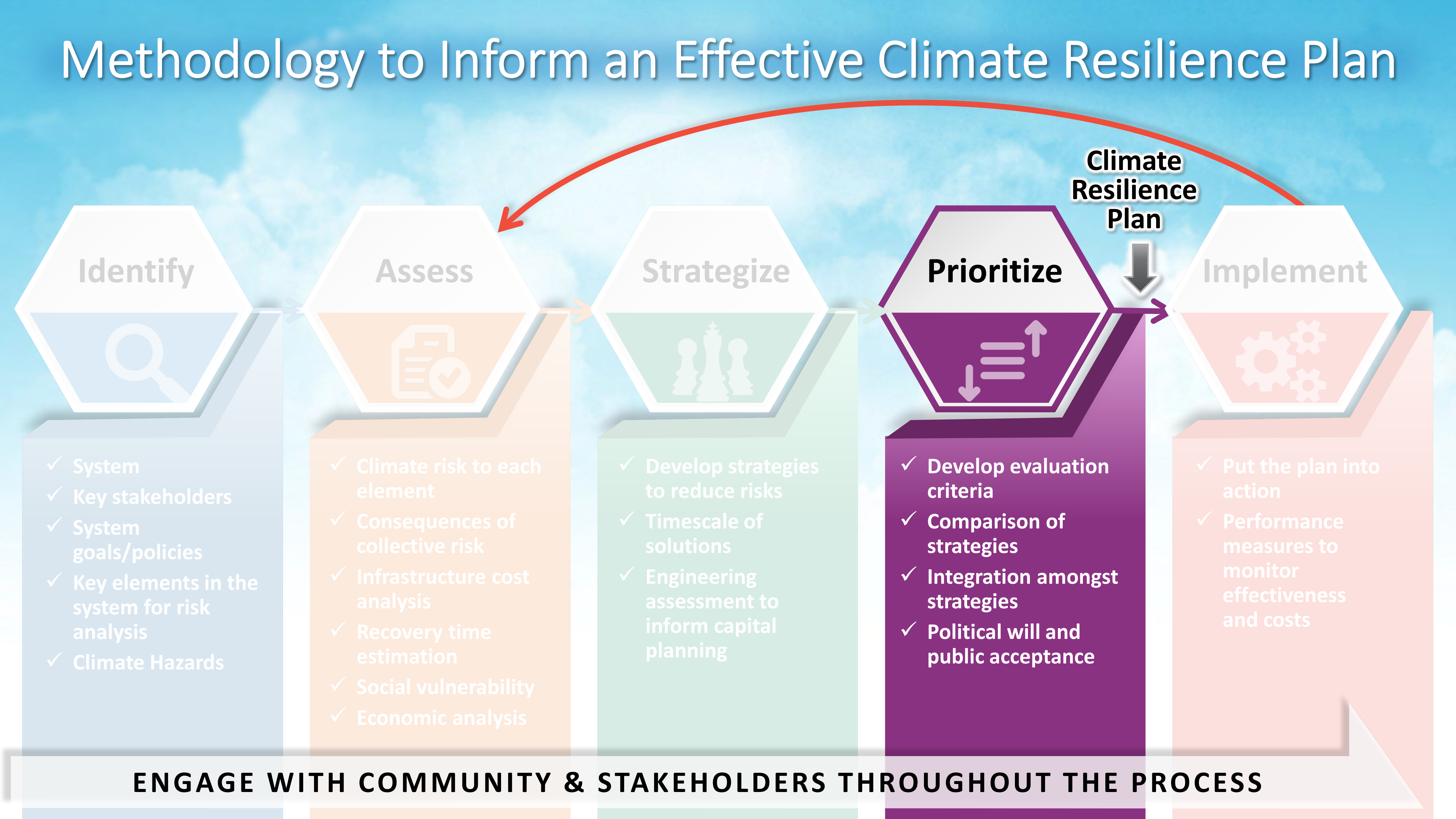
Consider

- Cost/financial feasibility – can it be incorporated into an investment plan/capital projects?
- Timeline of hazard (& likelihood) – is it already occurring or not projected until far into the future?
- Degree of Impacts and Consequences - How bad is the severity of impacts?

Timeline of Implementing Strategies



wsp



Methodology to Inform an Effective Climate Resilience Plan
Climate Resilience Plan
Identify
System
Key stakeholders
System goals/policies
Key elements in the system for risk analysis
Climate Hazards
Assess
Climate risk to each element
Consequences of collective risk
Infrastructure cost analysis
Recovery time estimation
Social vulnerability
Economic analysis
Strategize
Develop strategies to reduce risks
Timescale of solutions
Engineering assessment to inform capital planning
Prioritize
Develop evaluation criteria
Comparison of strategies
Integration amongst strategies
Political will and public acceptance
Implement
Put the plan into action
Performance measures to monitor effectiveness and costs
ENGAGE WITH COMMUNITY & STAKEHOLDERS THROUGHOUT THE PROCESS

Evaluate and Identify Top Strategies

Prioritize

- Relative costs to implement
- Losses avoided due to reduced risk
- Level of protection
- No regrets
- Community acceptance
- Environmental benefits
- Benefits to vulnerable populations
- Time and disruption to implement

Roles/ Responsibilities of Strategy Implementation

Prioritize

Financial

Logistical

Environmental

Political

Social (Community-Oriented)

wsp

Limitations and Barriers / Political Savviness

Prioritize

Political pressures – needs buy-in/ownership early

“Frame” community sensitivities in the system – e.g., nuclear power plant that’s vulnerable

Process for buy-in across stakeholders/leadership

Develop and Finalize Climate Resilience Plan

- Executive Summary
- Description of the System
- Current and Future Climate-Related Hazards
- Hazard-Related Risks & Consequences
- Strategies for Climate Resilience
- Implementation Plan of Strategies

Prioritize

Detail prioritized strategies to reduce climate risk

Identify timeline and milestones for strategy implementation

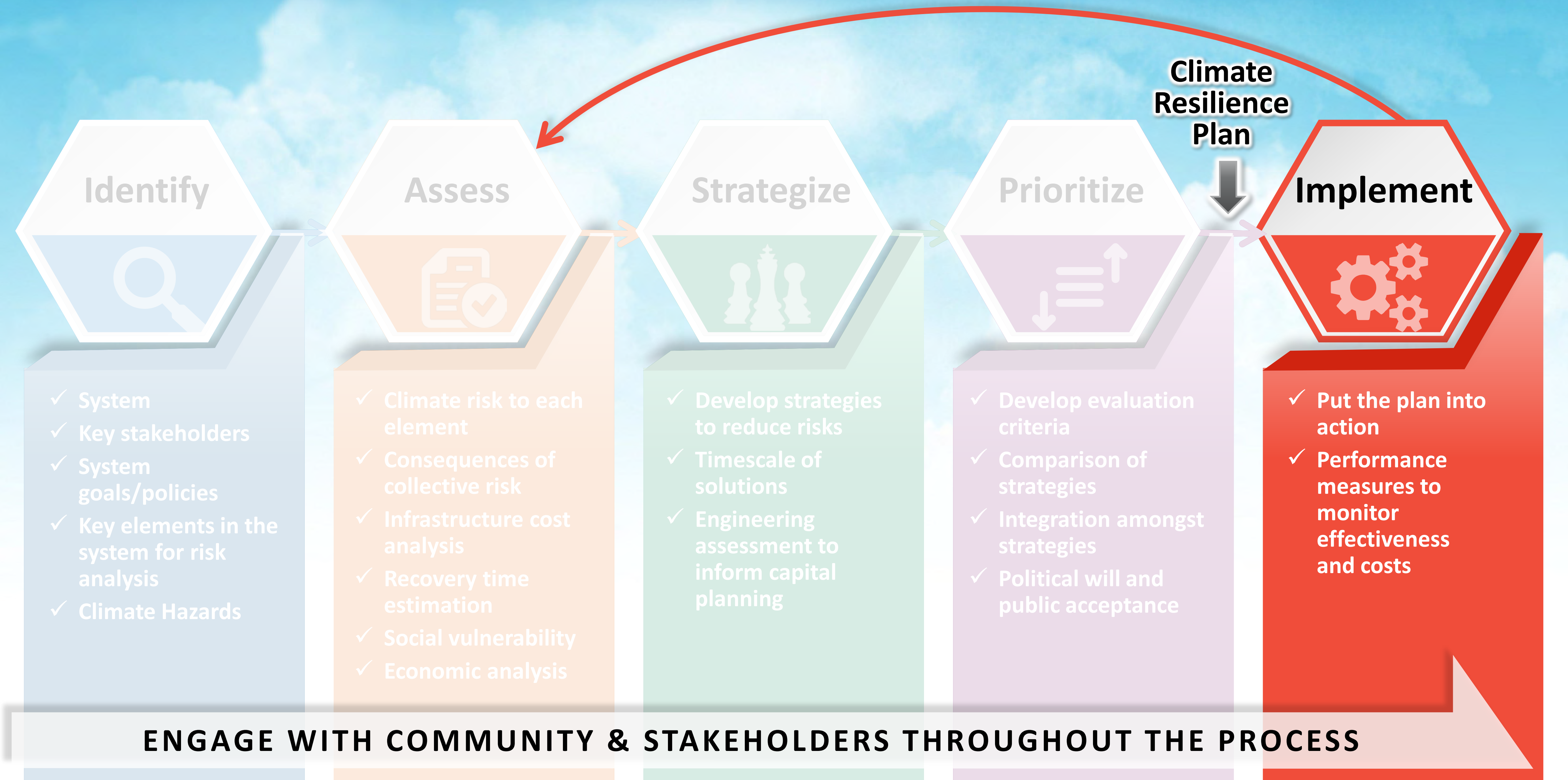
Identify responsibilities

Identify funding contributions

Develop succinct and telling graphics and text

Ensure draft plan is vetted with appropriate stakeholders and there is "buy-in"

Methodology to Inform an Effective Climate Resilience Plan



Climate Resilience Plan

Implement

Produce Plan

- Detail prioritized strategies to reduce climate risk
- Identify timeline and milestones for strategy implementation
- Identify responsibilities
- Identify funding contributions

Implement Plan

- Develop performance measures
  - Assess the performance of each strategy
- Identify critical factors that may be reducing strategy effectiveness

Review and Revise Plan

- Every few years monitor and revise as needed

THANK YOU

Mike Flood, Michael.Flood@wsp.com, 202-748-6131