UNC ASHEVILLE NEMAC+FernLeaf

Taking Models and Making Meaning

Public-Private Partnership for Resilience Solutions

UNC ASHEVILLE NEMAC + FernLeaf

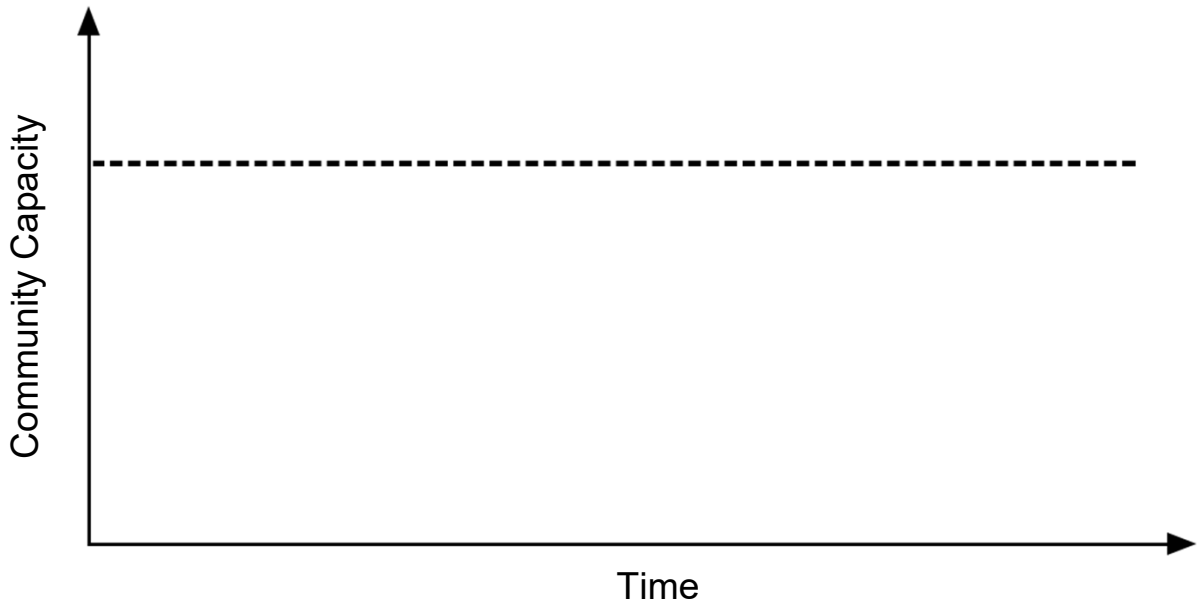
UNC Asheville NEMAC National Environmental Modeling & Analysis Center

Applied research center

FERNLEAF INTERACTIVE

Private solutions firm

What is Resilience?



Modified from Resilience Loss Recovery Curve, Source: White et al. (2015), p. 203, Adapted from model derived by M.E. Hynes, b. Ross and CARRI (2008), presented at the DHS University Summit, Washington, DC

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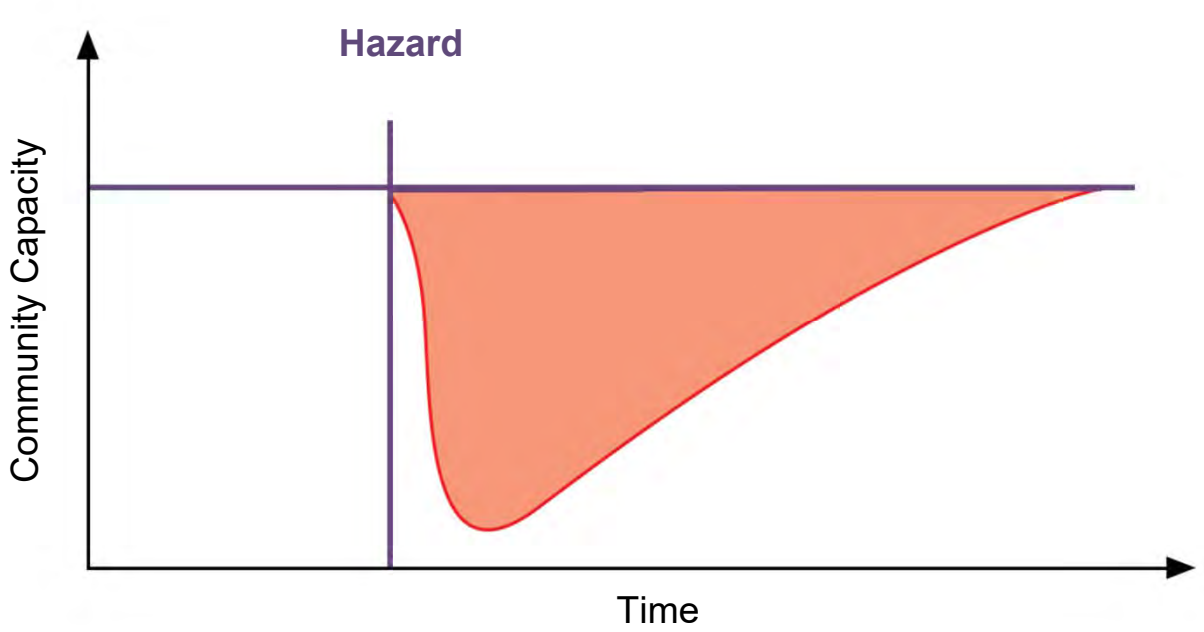

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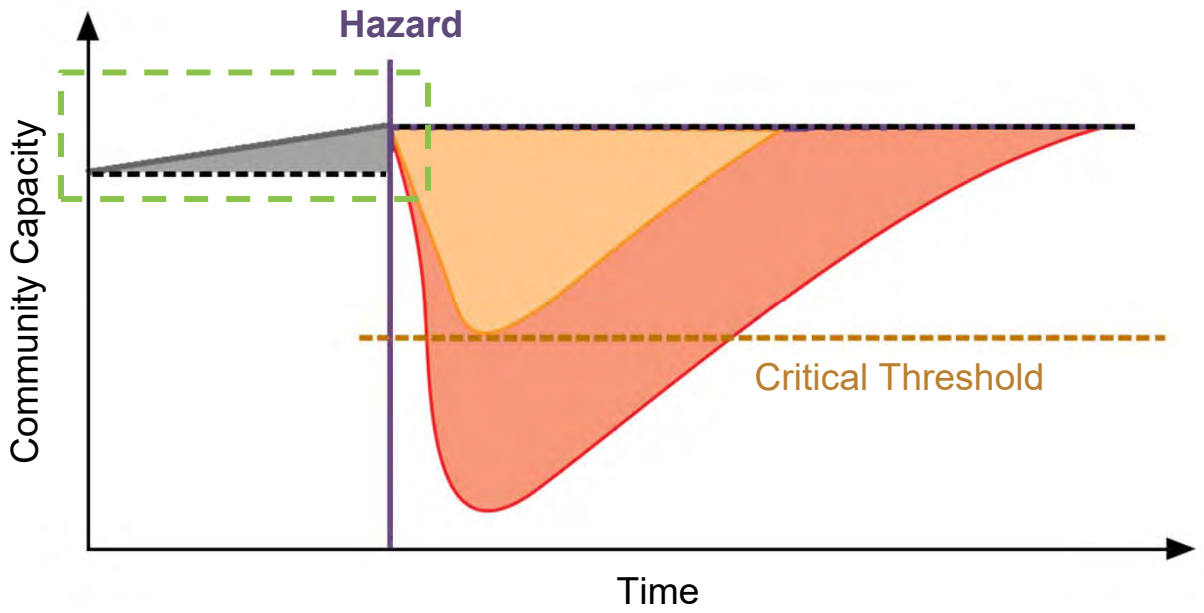

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Steps to Resilience

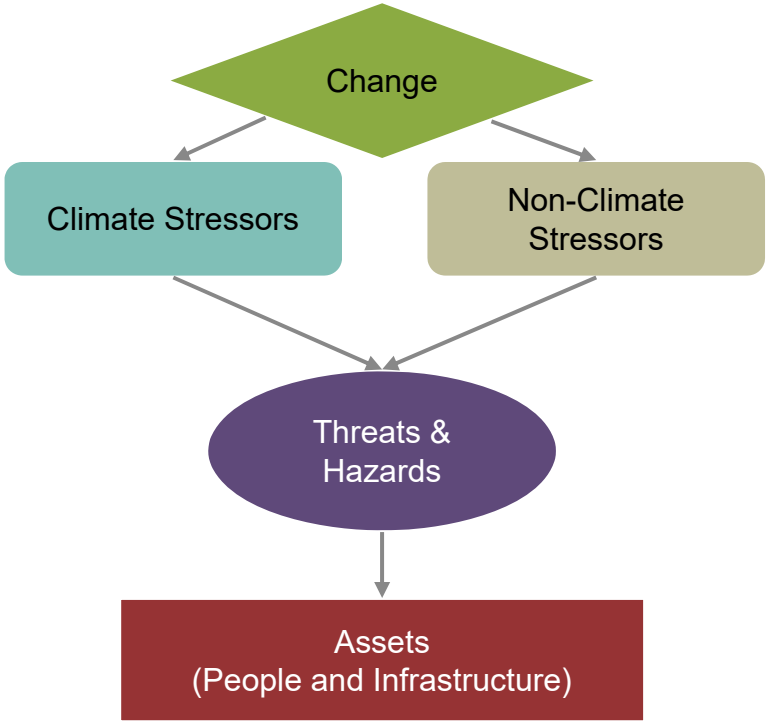
U.S. Climate Resilience Toolkit
toolkit.climate.gov

Outcomes

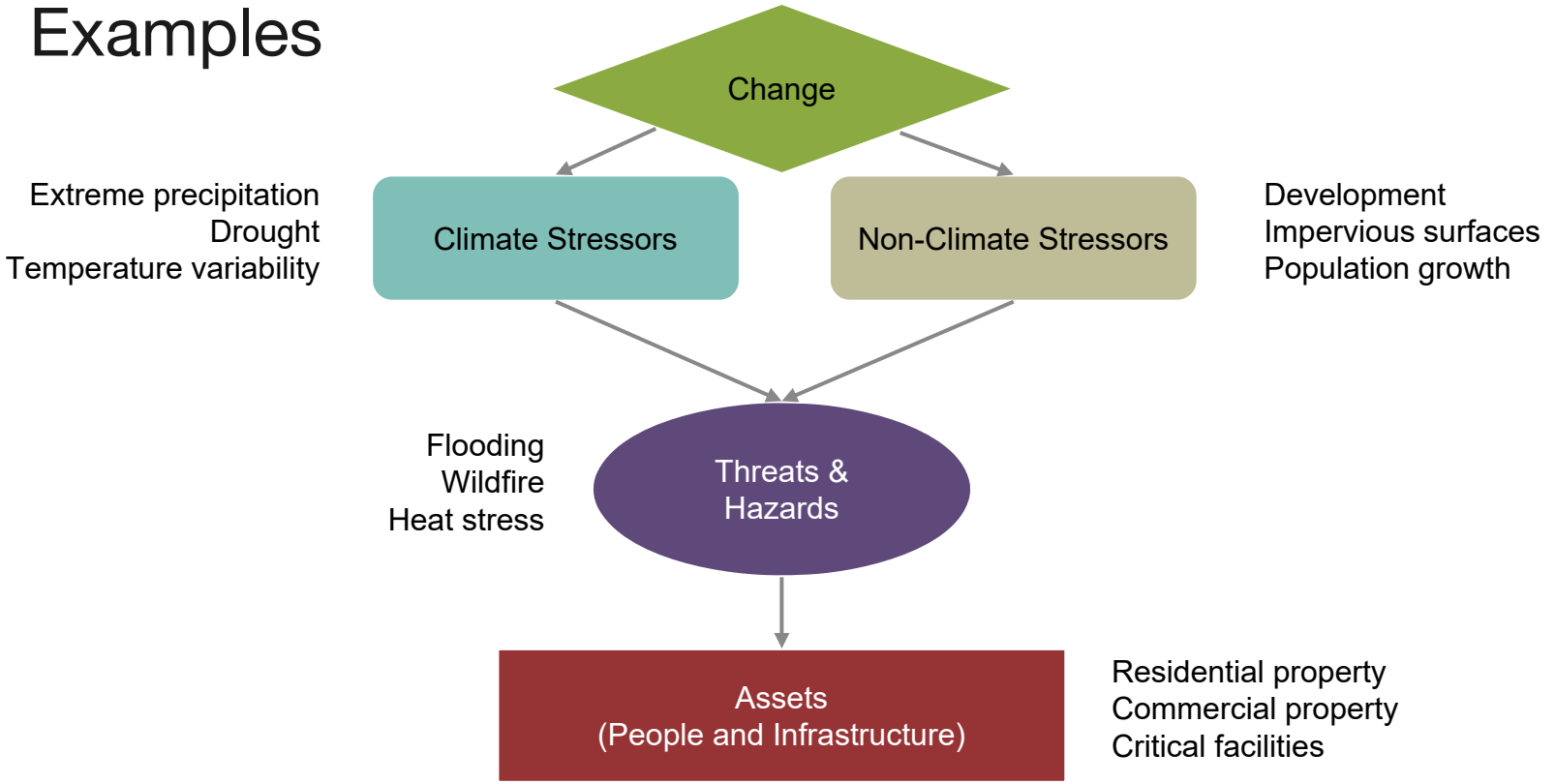
- ✓ Tailored assessment process
- ✓ Prioritized plan for actions and strategies
- ✓ Transparent and defensible priorities
- ✓ Increased capacity for staff

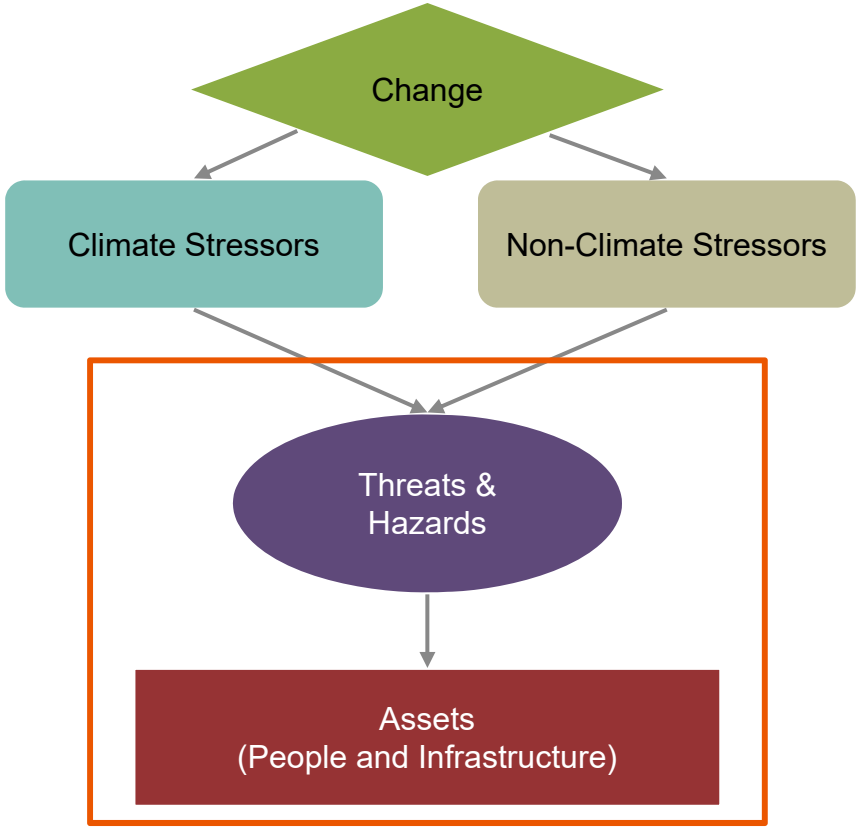
Resilience Conceptual Model

- We do **not** make decisions on climate alone
- Climate must be integrated across sectors with other **threats** and stressors
- Decisions are driven by **values** attached to **assets**
- **We must consider how stressors have changed and are projected to change**

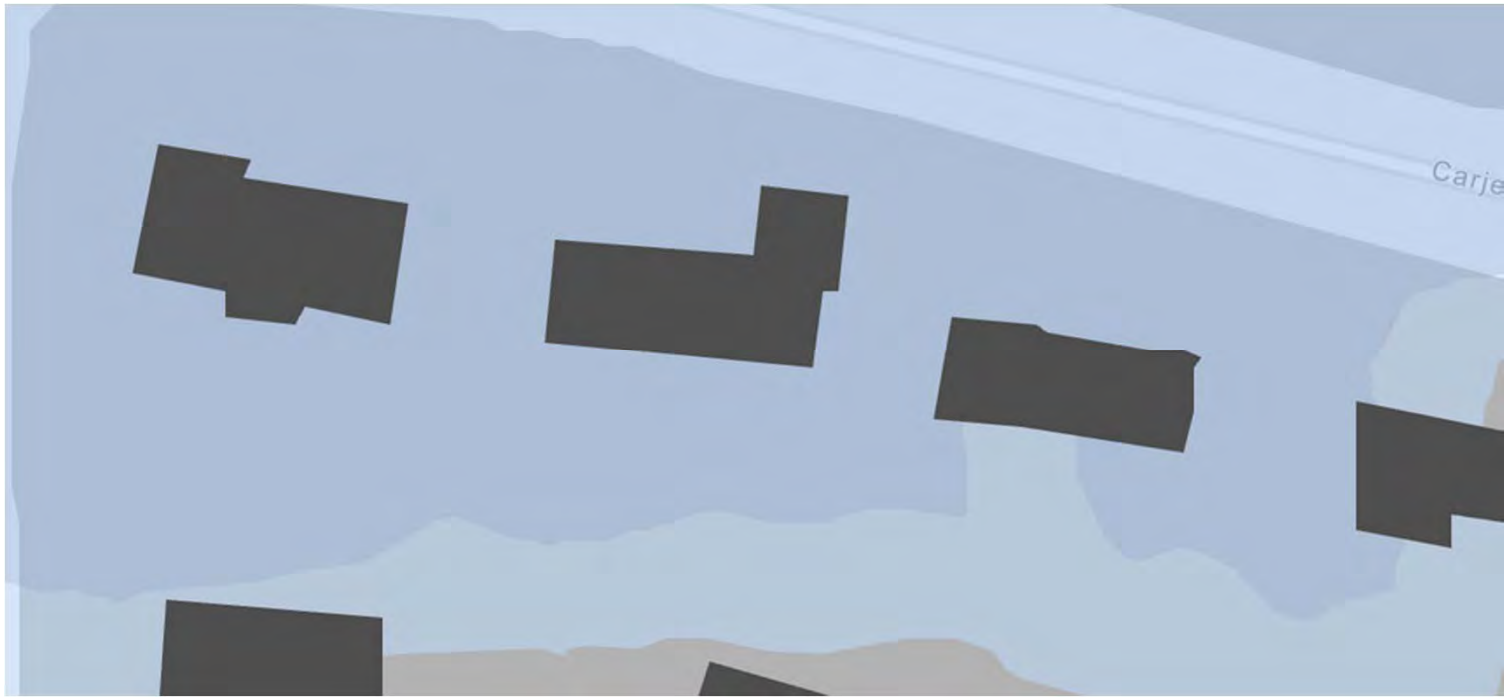


Examples


Change
Climate Stressors
Non-Climate Stressors
Threats & Hazards
Assets (People and Infrastructure)
Extreme precipitation
Drought
Temperature variability
Development
Impervious surfaces
Population growth
Flooding
Wildfire
Heat stress
Residential property
Commercial property
Critical facilities


Change
Climate Stressors
Non-Climate Stressors
Threats &
Hazards
Assets
(People and Infrastructure)

Same exposure to flooding…



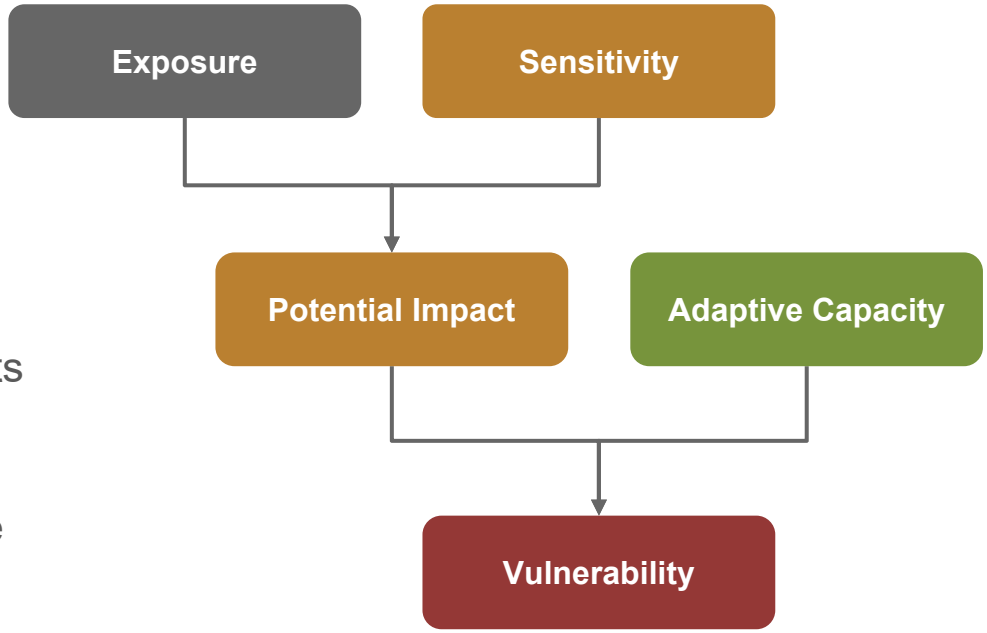
… very different vulnerability

Vulnerability

Understanding the susceptibility of societal assets due to physical and social factors.

Sensitivity: the degree to which assets are affected by a threat

Adaptive Capacity: the ability to cope with impacts

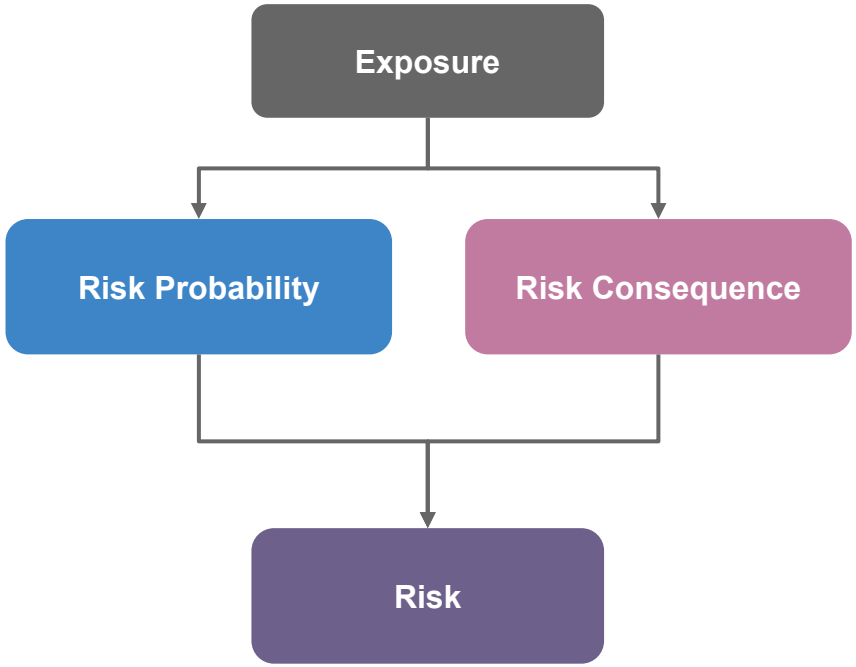


Risk

Understanding the probability and negative outcome of threats.

Probability: the likelihood of a threat or hazard event occurring

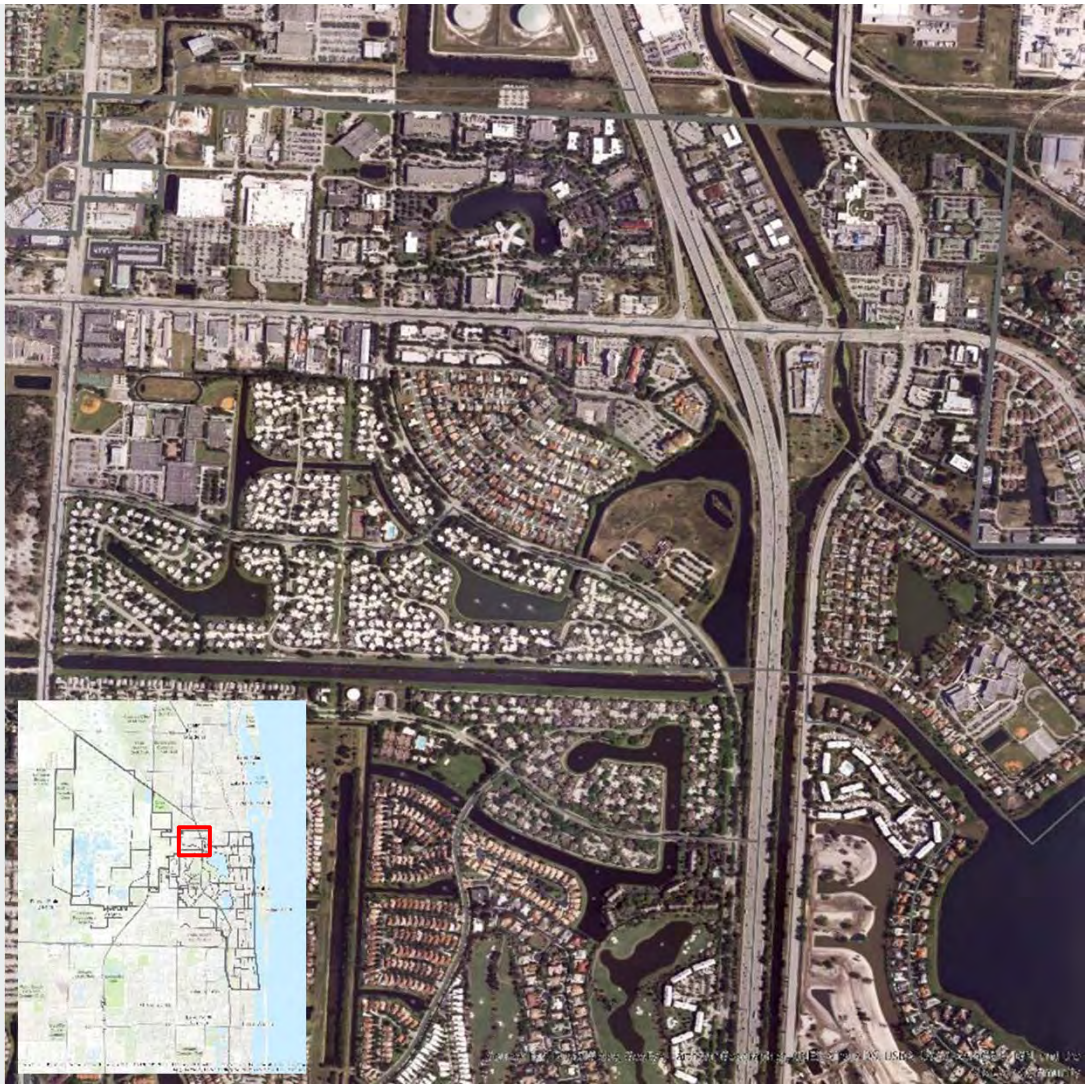
Consequence: the negative outcome of a threat or hazard event



Vulnerability and Risk at Asset scale

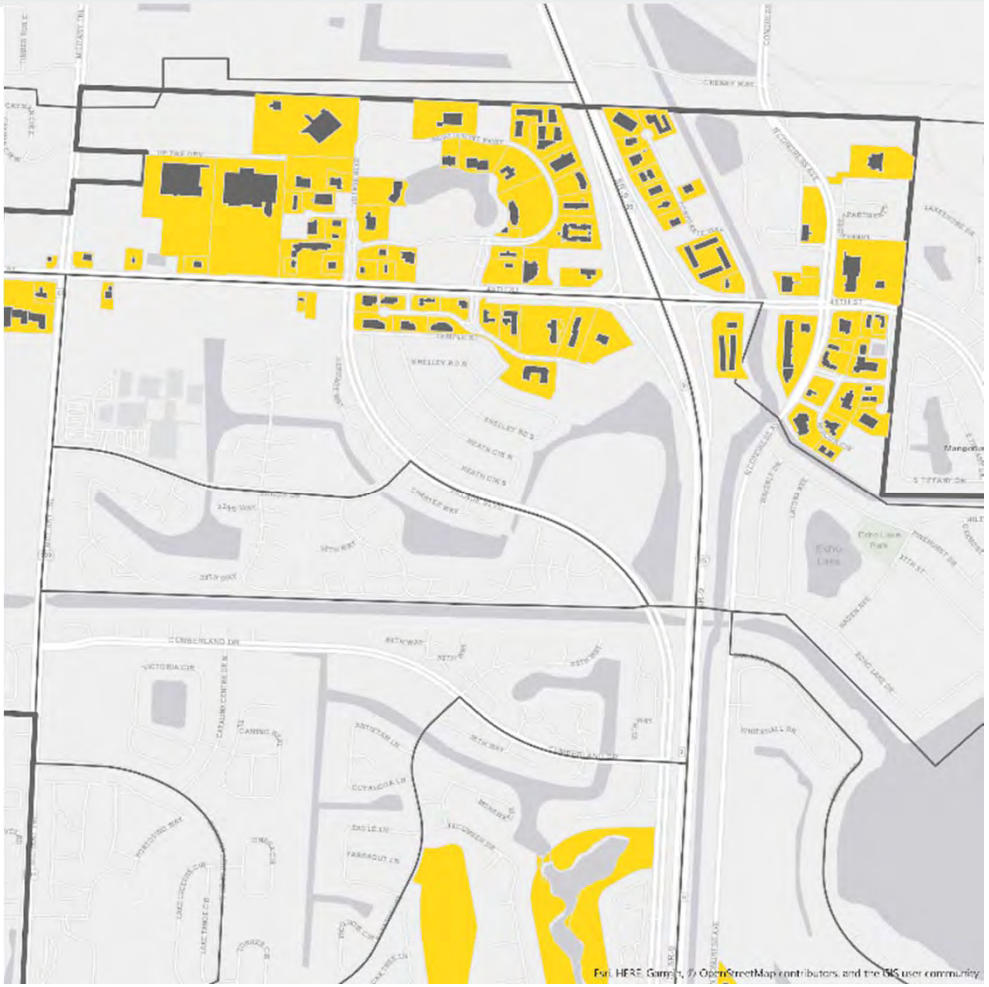
Example: Commercial Property and Rainfall-induced Flooding

West Palm Beach, Florida



Asset: Commercial parcels and buildings

(non-commercial parcels/buildings are not shown)

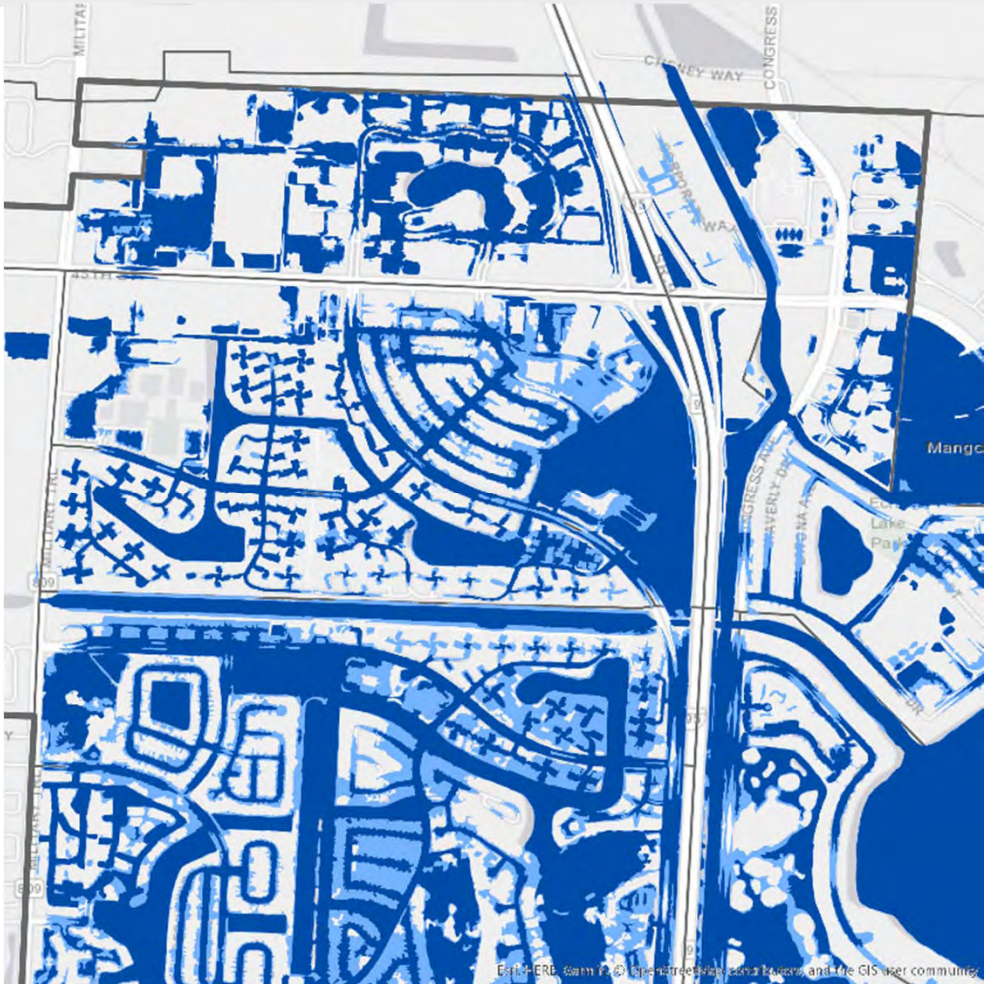


Threat: Rainfall-induced Flooding

Collective Water Resources + Jones Edmunds & Associates ICPR model outputs (WPB SWMP)

100yr-72hr extent

500yr-72hr extent



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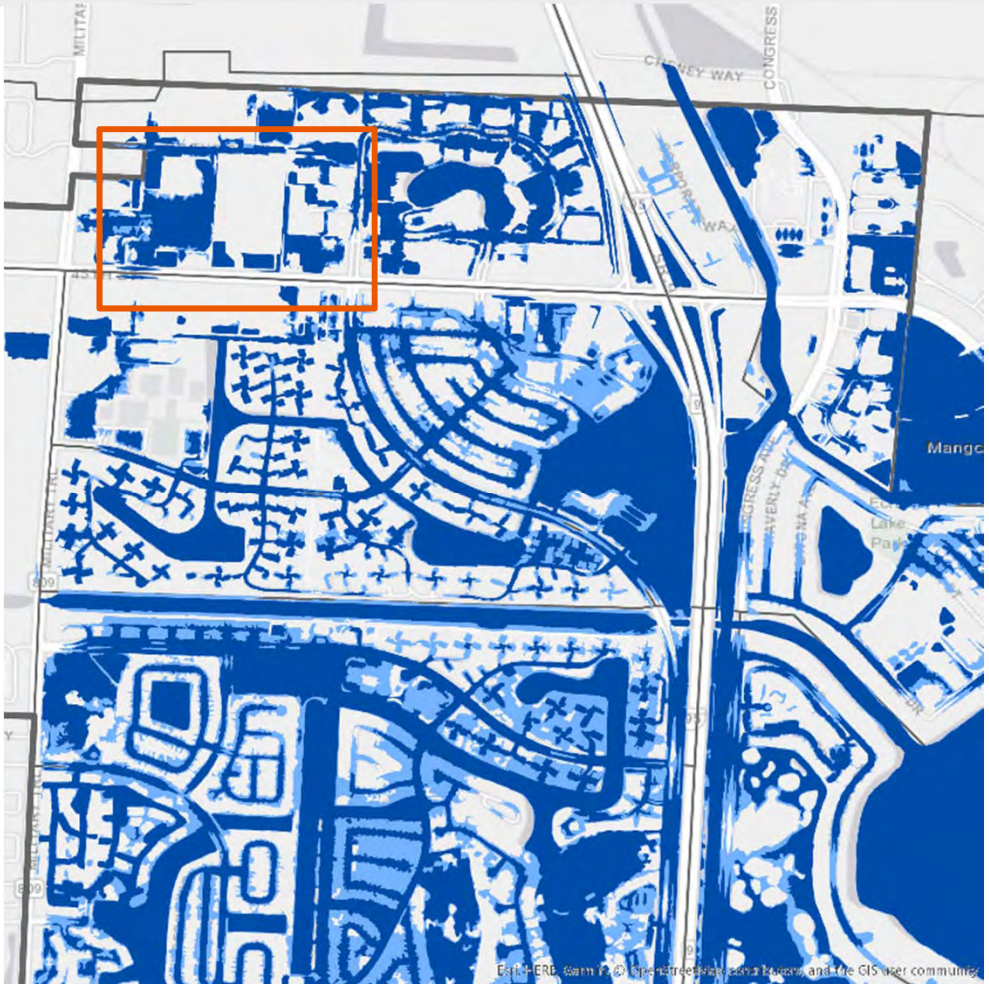
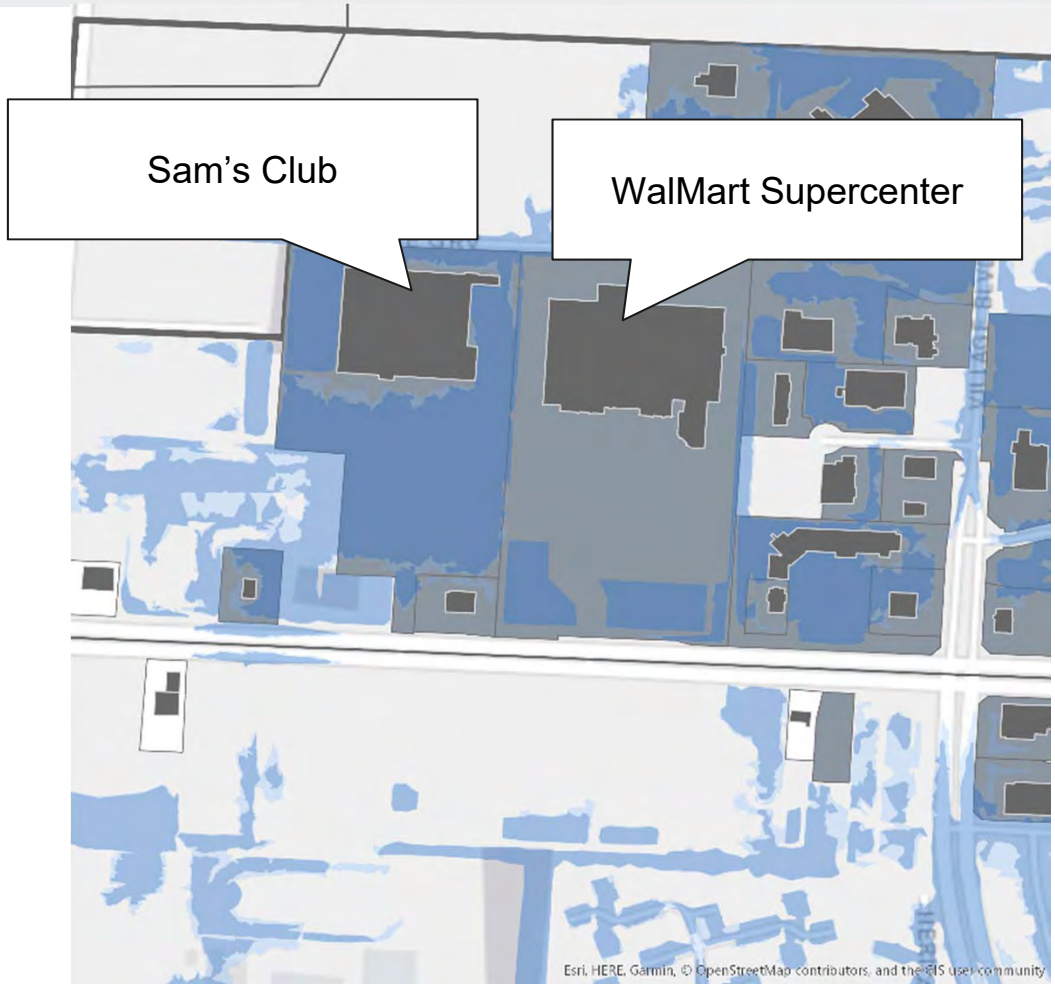


A tale of two brothers

On large parcel on the left is a Sam's Club, on the right is a WalMart Supercenter.

Both properties are exposed to Rainfall-induced Flooding.




urant Depot
Lockheed
Sam's Club
Subway Restaurants
unbelt Rentals
Village Boulevard KinderCare
Commerce Pl
Sprint Store
Healthy Habit Cafe
North Village Square
co Bell
McDonald's
45th St
45th St
45th St
45th St
45th St
45th St
Valvoline Instant Oil Change
D&B Tile of

Potential Impact

Both are retail properties. Sam's Club structure is exposed to Rainfall-induced flooding, WalMart structure is not.

Darker = Higher potential impact

Adaptive Capacity

Sam's Club

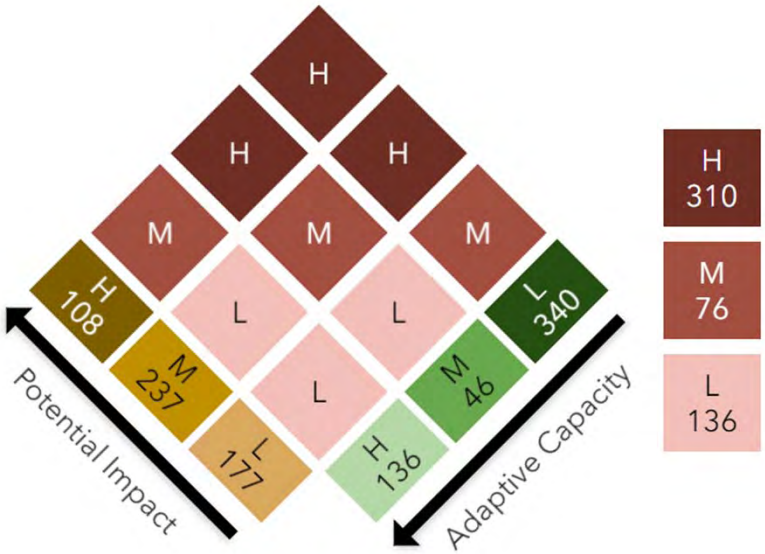
- Built 1991
- Structure is within ICPR flood extent, but not in FEMA regulatory flood zone

WalMart Supercenter

- Built 2009
- Structure not in flood extent (structure and parking lot elevated)

Darker = Lower adaptive capacity

Vulnerability



Preliminary analysis: Commercial Property & Rainfall-induced flooding

Risk Probability

Sam’s Club structure is within 100-yr flood extent.

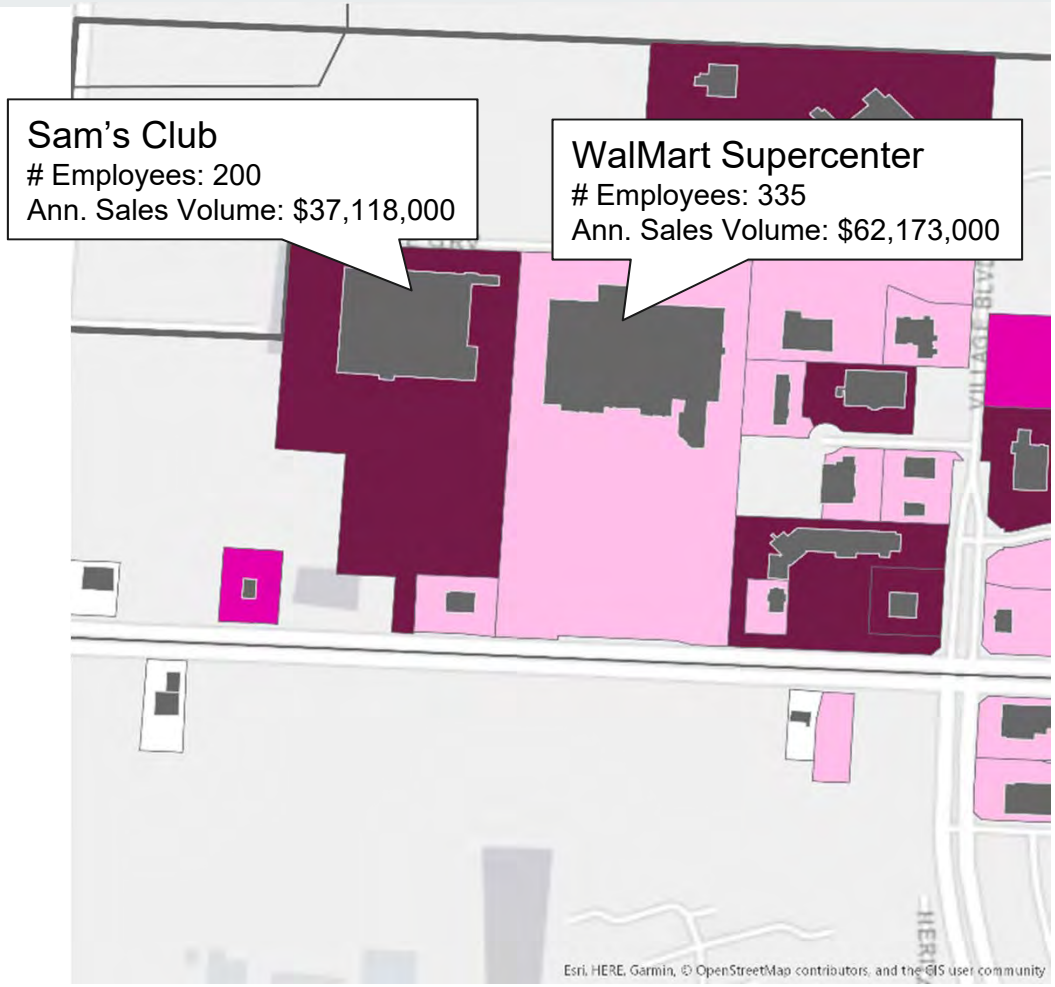
Darker = Higher probability

Risk Consequence

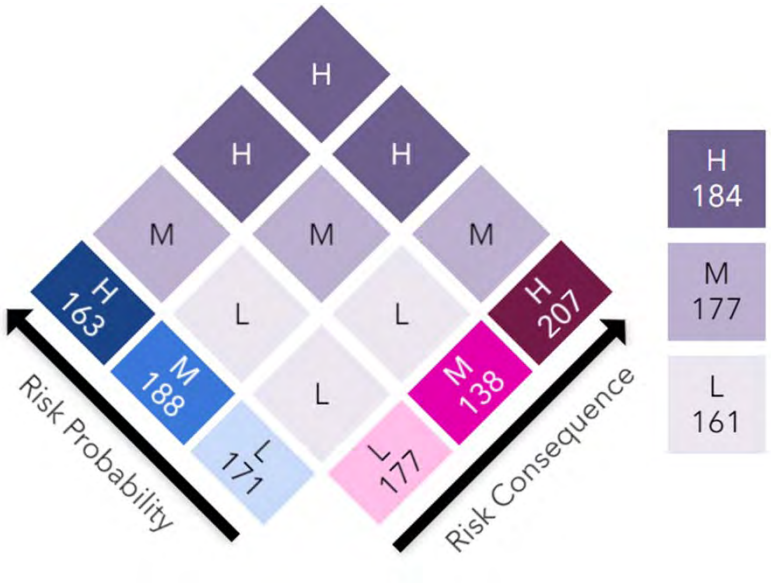
Asset replacement cost is only one aspect: business disruption can often be a larger issue...

Both have above median annual revenue and employees, but Sam's Club structure is exposed.

Darker = Higher consequence

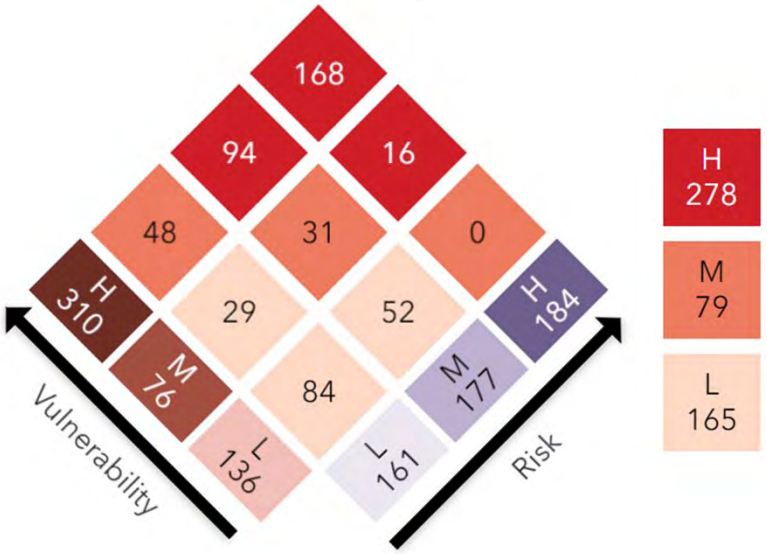


Risk



Preliminary analysis: Commercial Property & Rainfall-induced flooding

Combined Vulnerability and Risk



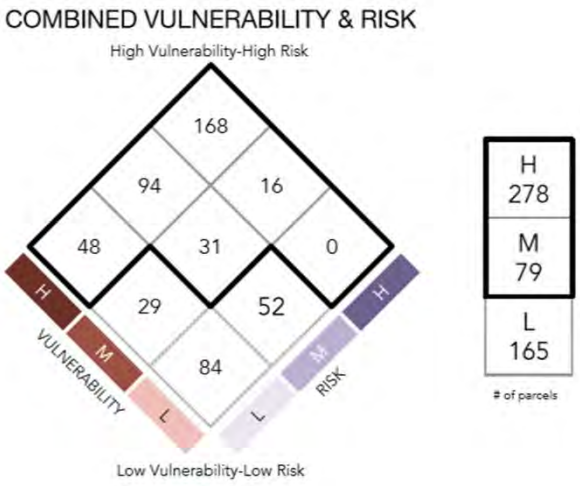
Preliminary analysis: Commercial Property & Rainfall-induced flooding

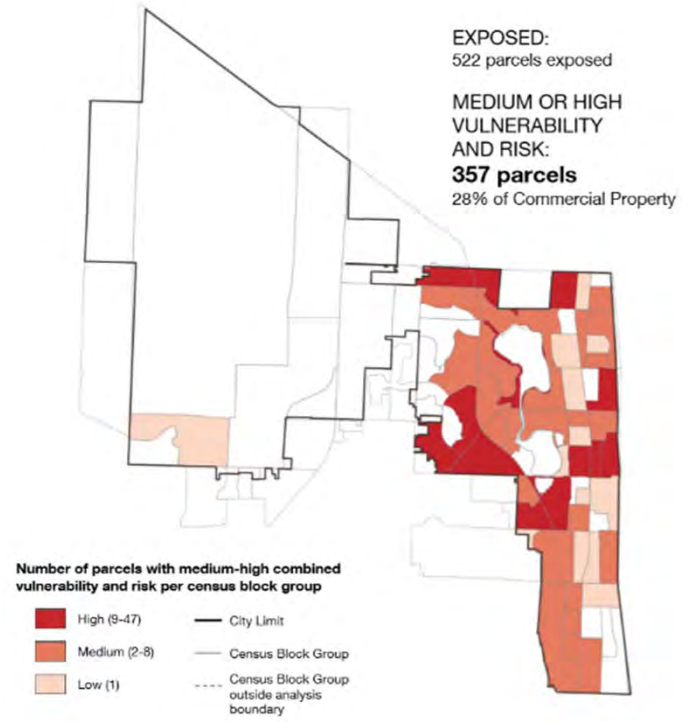
Focus on the most vulnerable and at risk

Commercial Property & Rainfall-Induced Flooding

EXPOSED:
522 parcels exposed

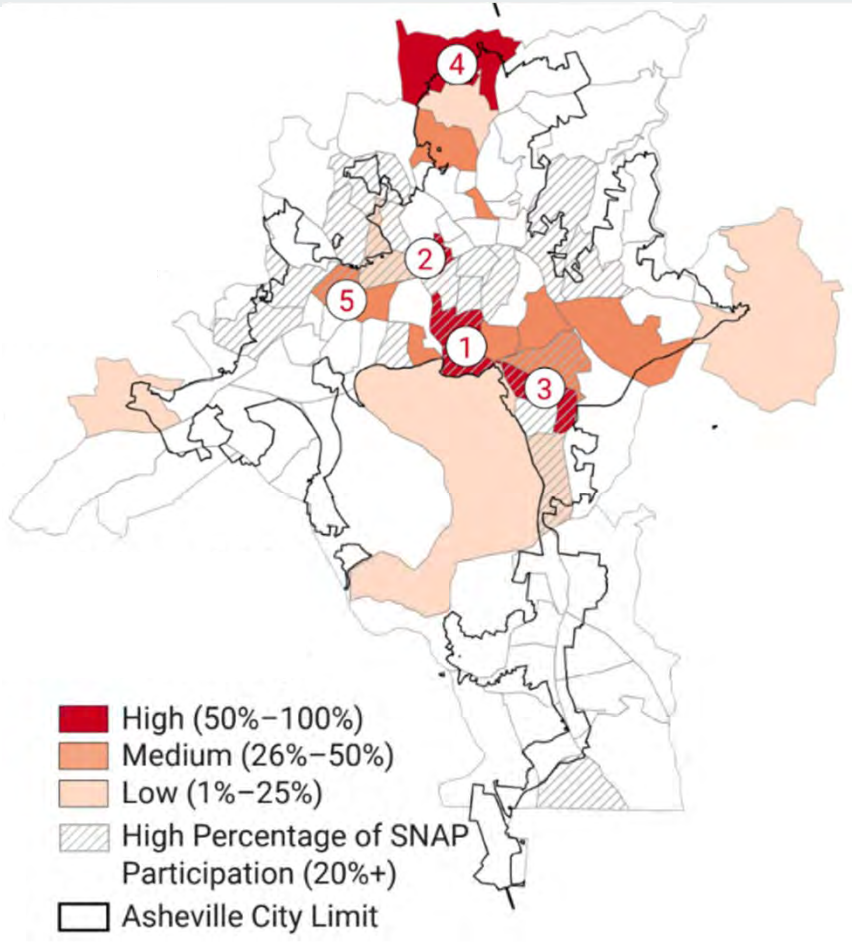
MEDIUM OR HIGH VULNERABILITY AND RISK:
357 parcels
28% of Commercial Property





Socially vulnerable areas

- Think about equitability as an additional lens



Access and mobility

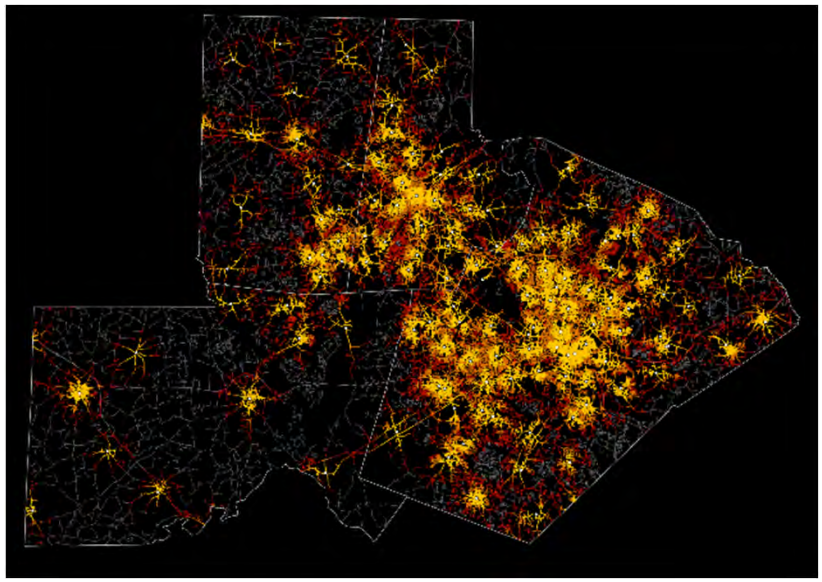
- Often assets becoming inaccessible can be a major issue
  - Emergency access
  - Commercial disruption

Business-as-usual

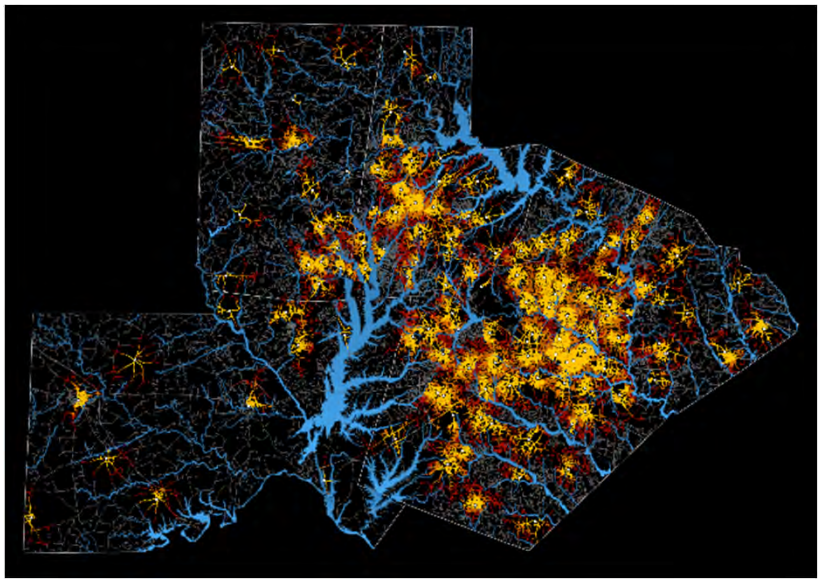
During a major flood event

3-minute emergency response time
5-minute emergency response time
8+ minute emergency response time
500-year floodplain

Business-as-usual

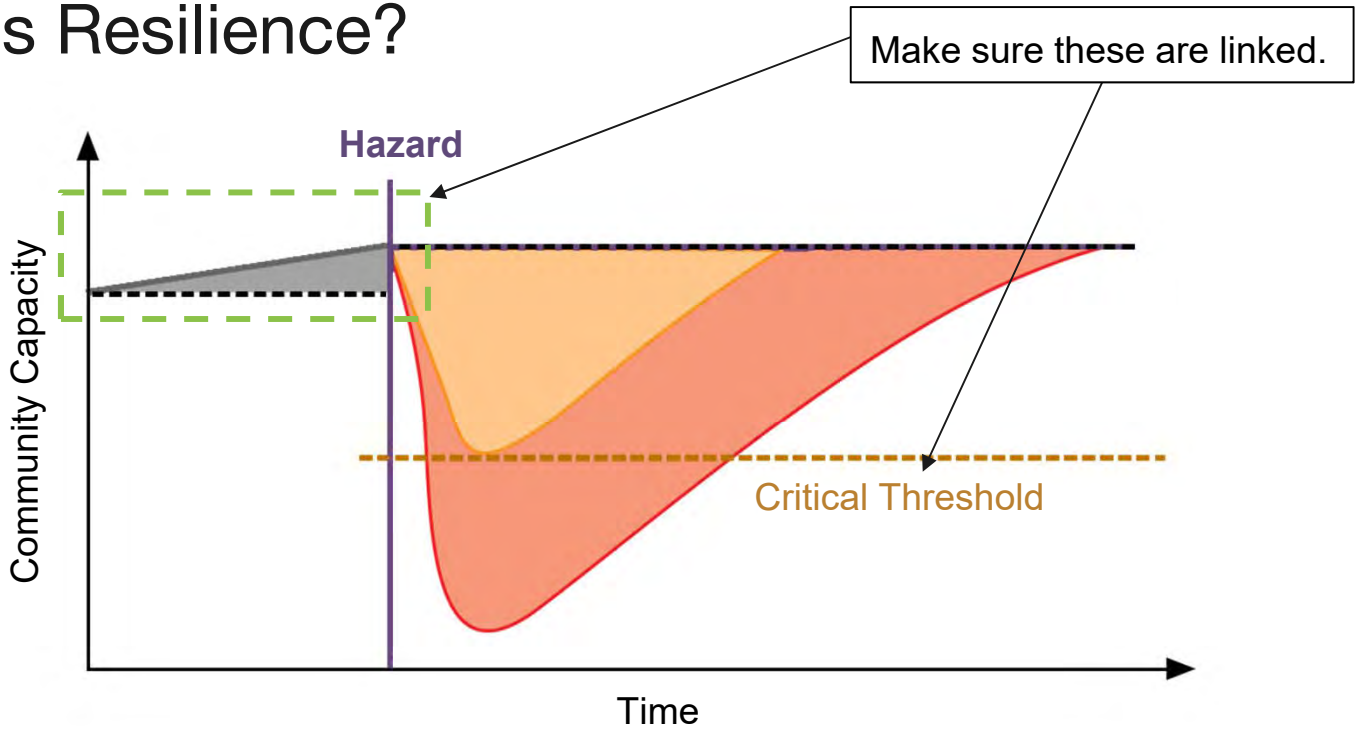


During a major flood event



3-minute emergency response time
5-minute emergency response time
8+ minute emergency response time
500-year floodplain

What is Resilience?



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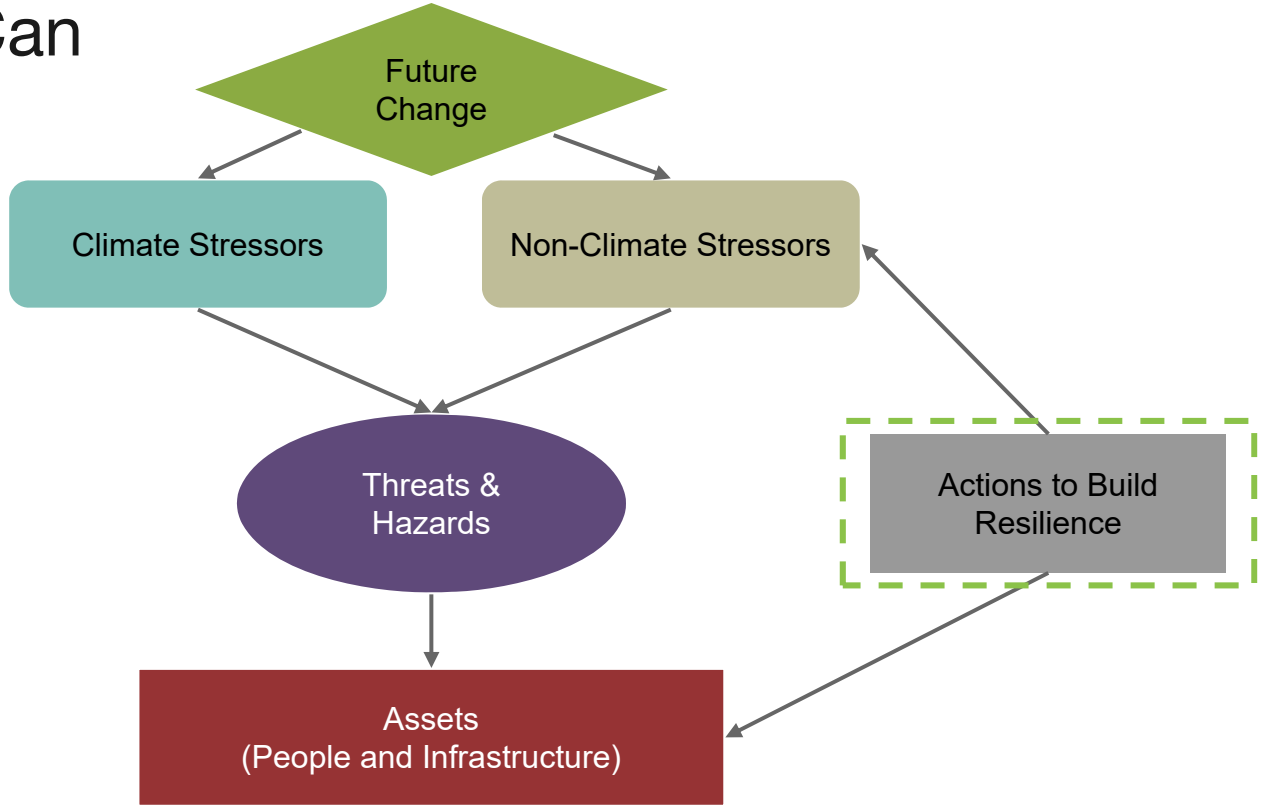
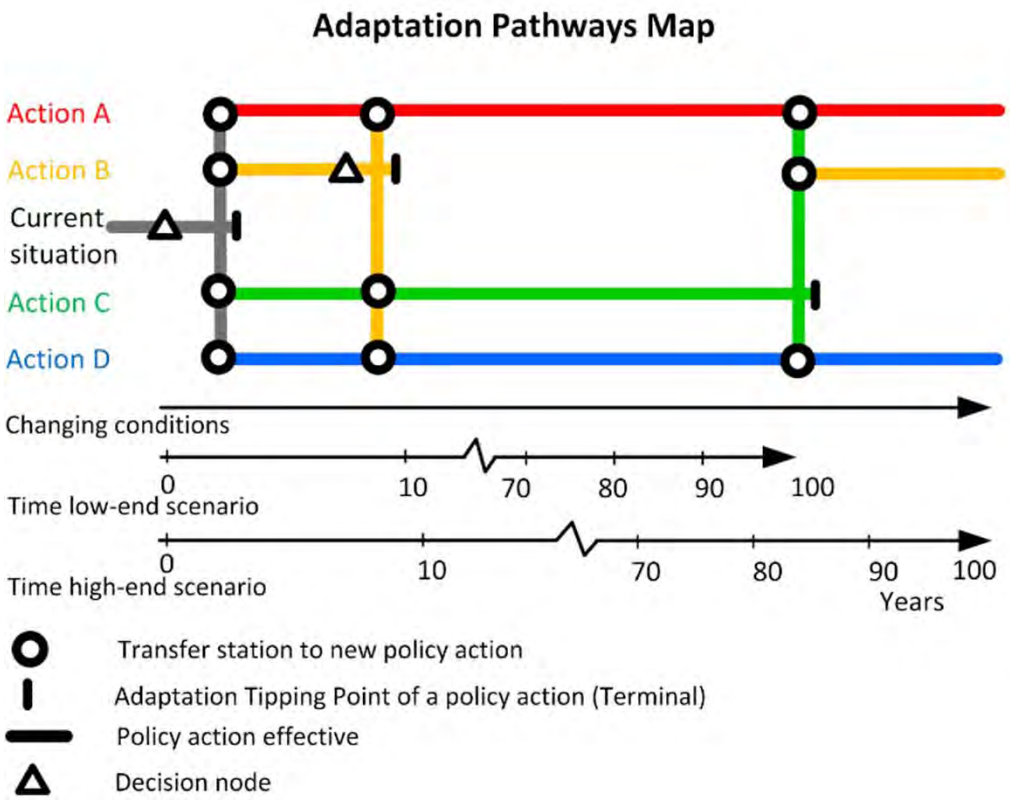
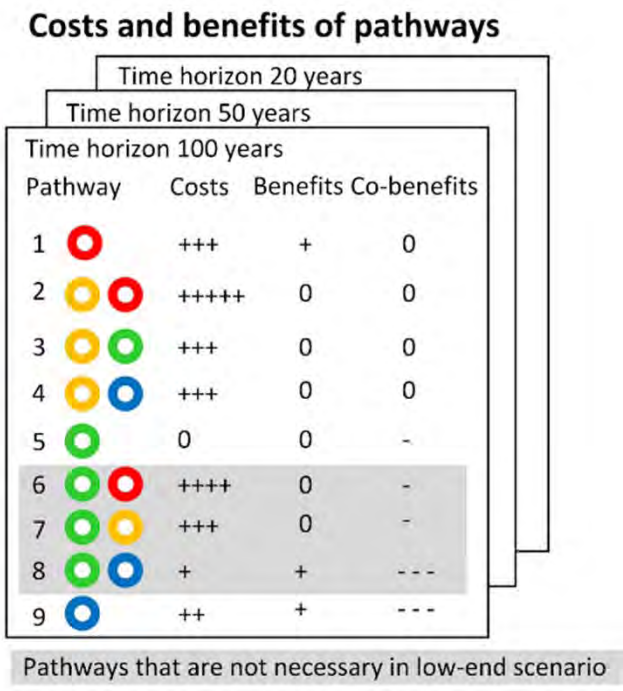
What We Can Influence

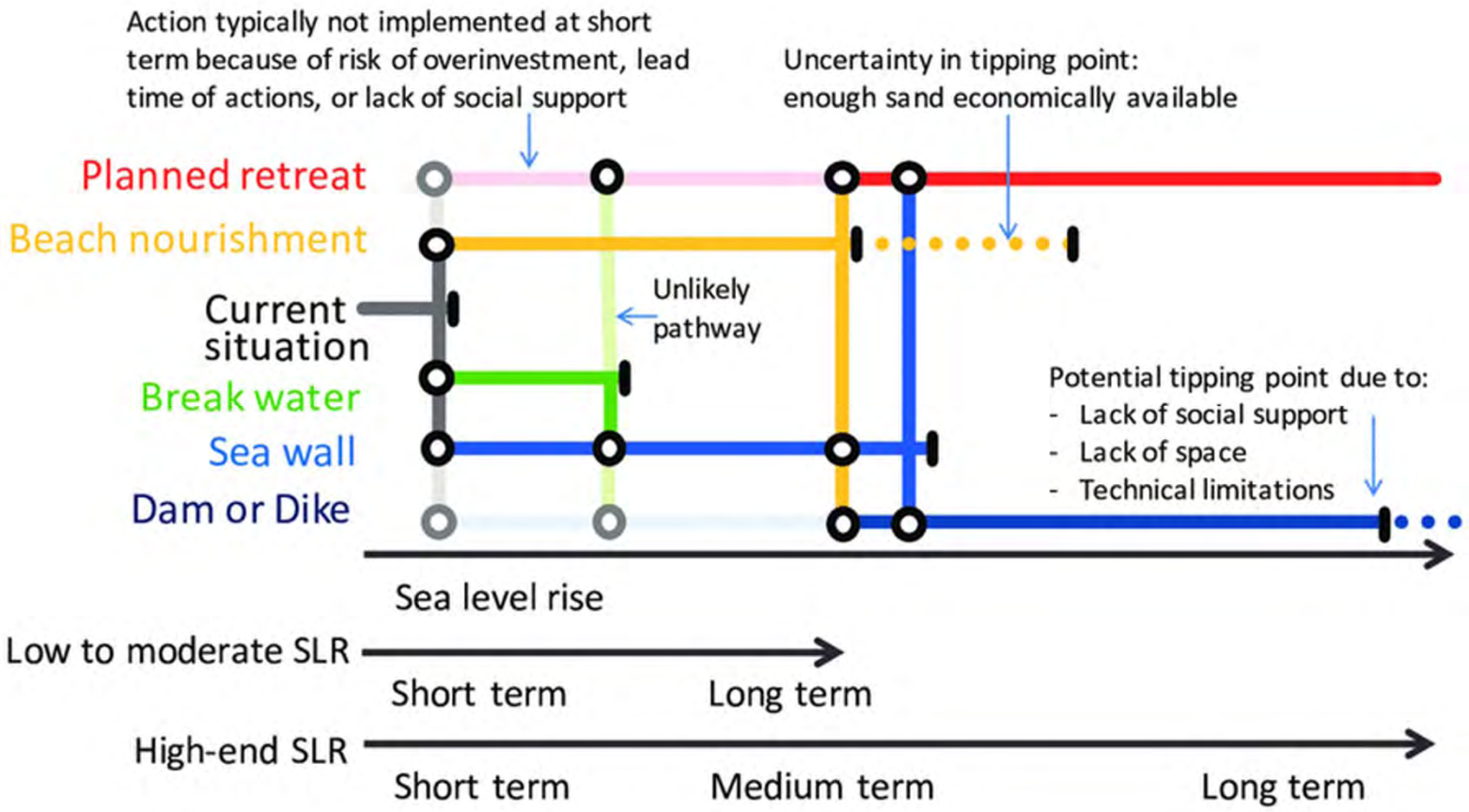


We may not see the largest changes.
What we build will.

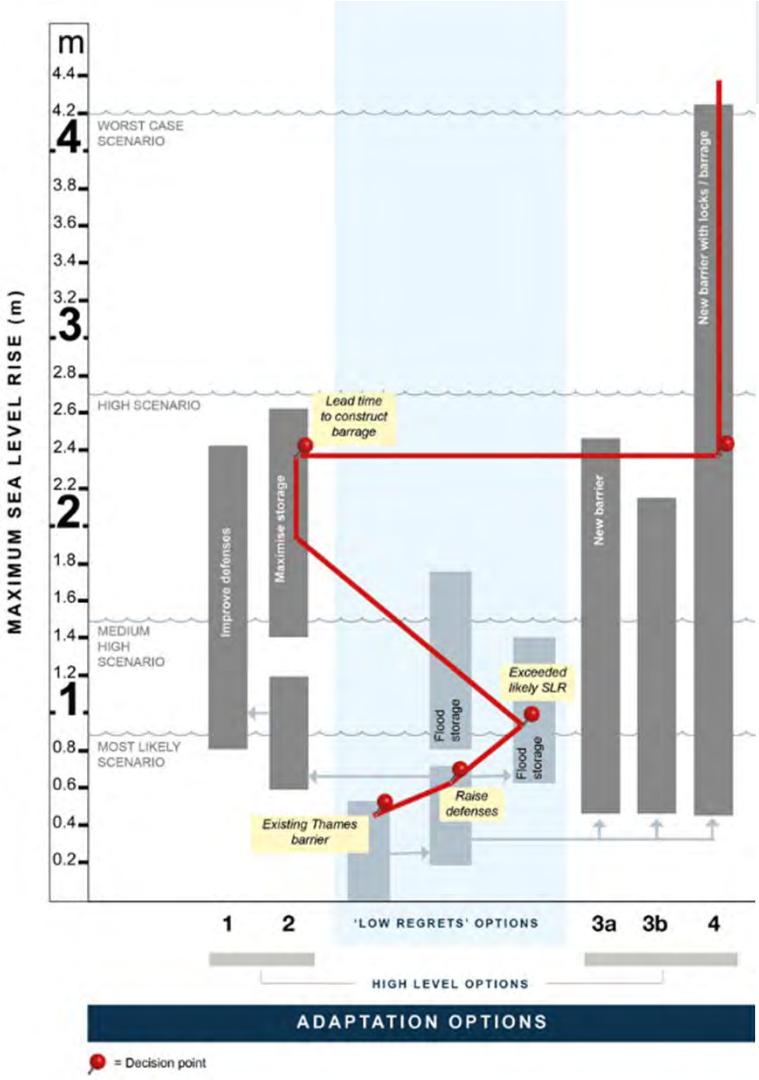




https://www.deltares.nl/en/adaptive-pathways/



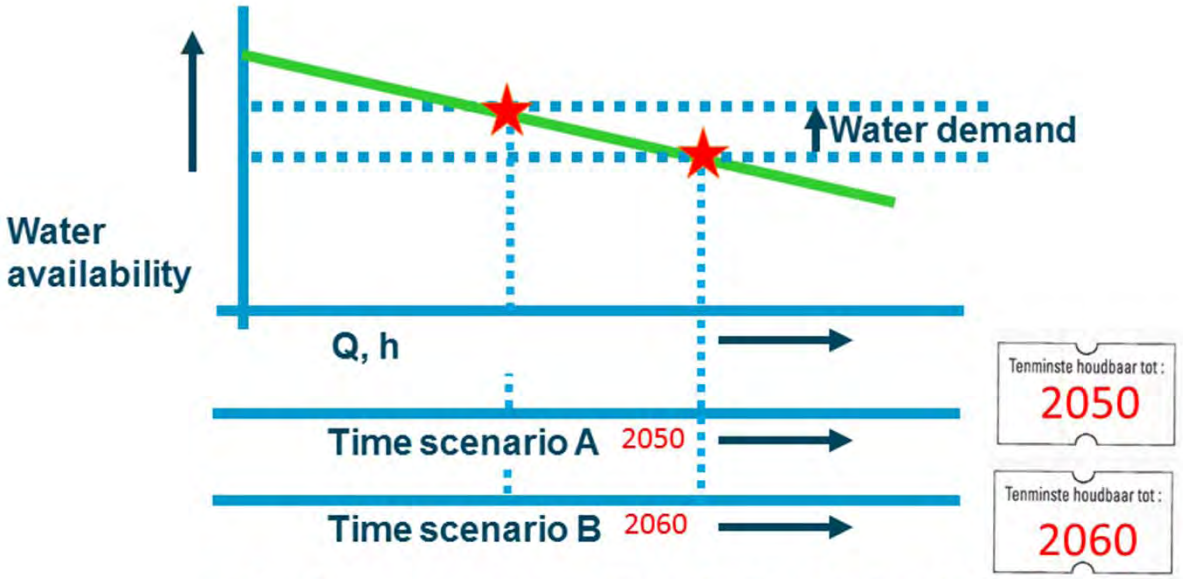
(Haasnoot et al. 2013).



Planning for London's future flood defences. Source: Modified from HM Treasury and DEFRA 2009, and Reeder and Ranger 2011.

Adaptation Tipping Point & Use by date of policy action

A stress test: How much (climate) change can we cope with?
When do start to achieve missing our objectives?



Decision moment = f (time A, time B, lead time action)

Kwadijk, J.C.J. et al 2010 WIRES Climate Change DOI: 10.1002/wcc.64, Haasnoot et al 2012 Climatic Change

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Thank you!

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