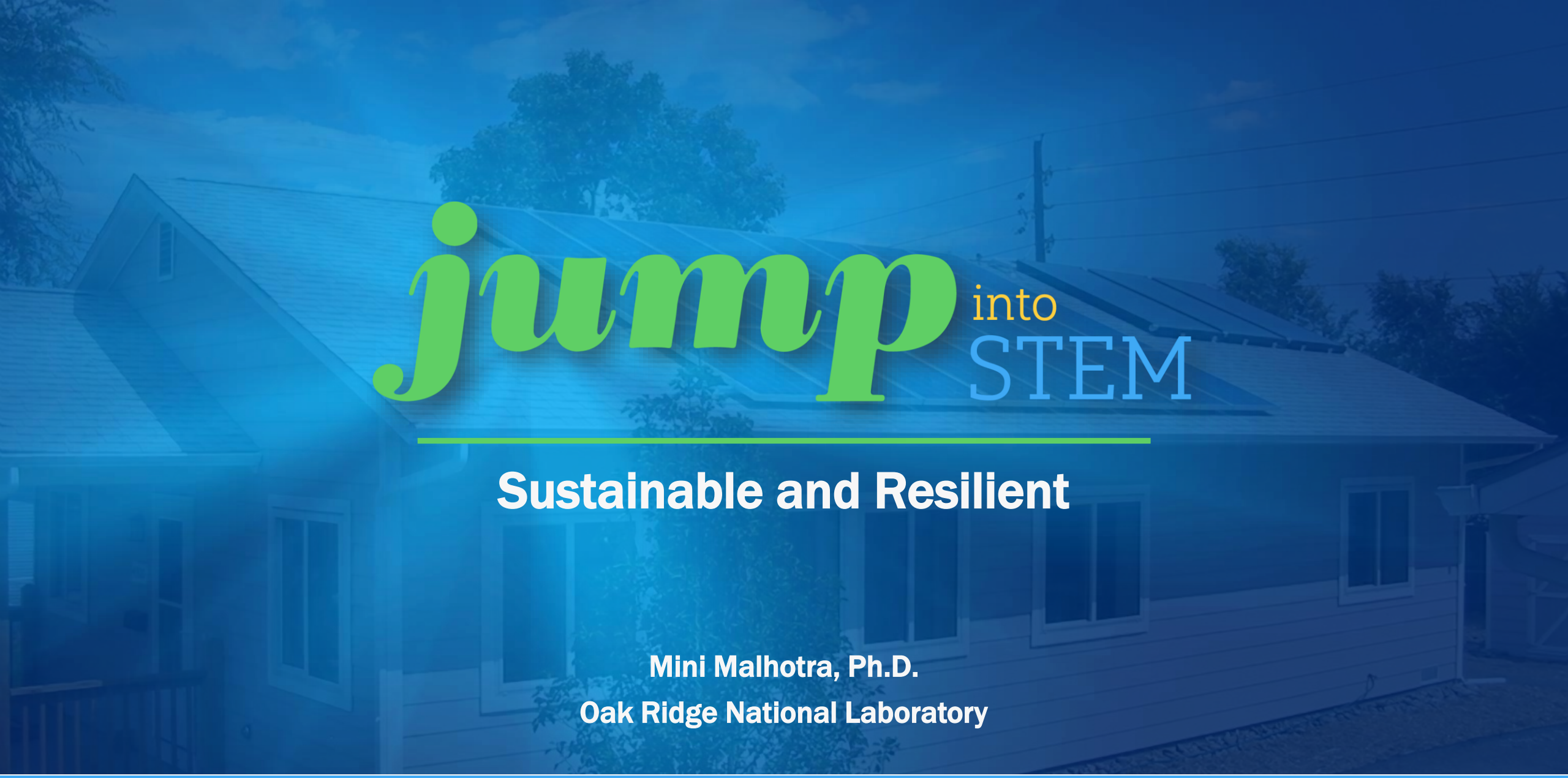

Sustainable and Resilient

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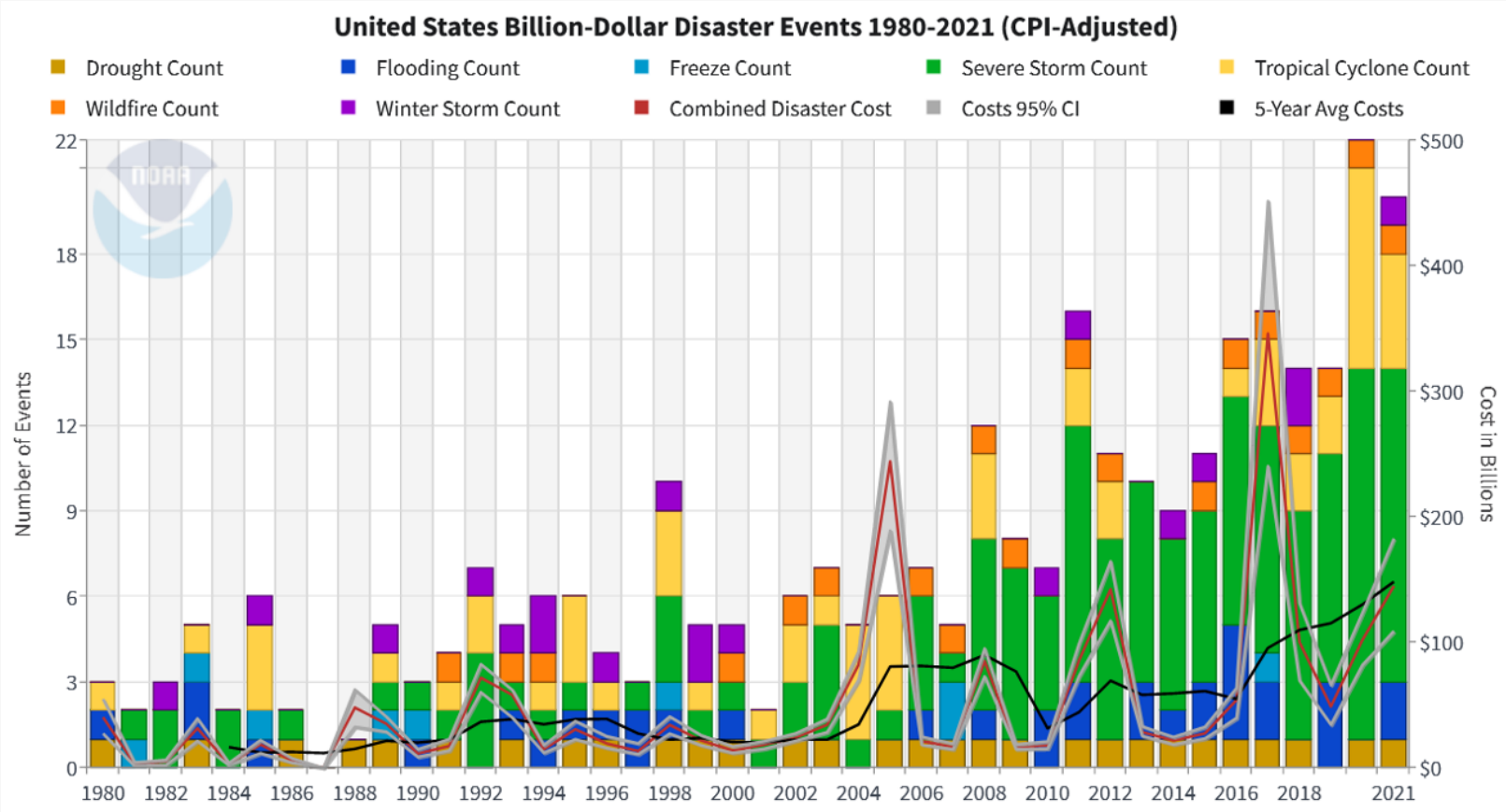
BUILDING TECHNOLOGIES OFFICE
OAK RIDGE National Laboratory
NREL Transforming ENERGY
Pacific Northwest NATIONAL LABORATORY

Context
Impacts of Climate Change

jump into STEM

- Extreme weather events
  - Increased frequency and intensity
  - Can occur in combinations and rapid succession
  - Become disasters when more assets are at risk of damage



Source: https://www.climate.gov/news-features/blogs/beyond-data/2021-us-billion-dollar-weather-and-climate-disasters-historical

Context
Impacts of Climate Change

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- Extreme weather events
  - Damage natural and built environment & infrastructure
  - Pose threat to public health, safety, and well-being

Photo Credit: Marc Guitard/Moment via Getty Images

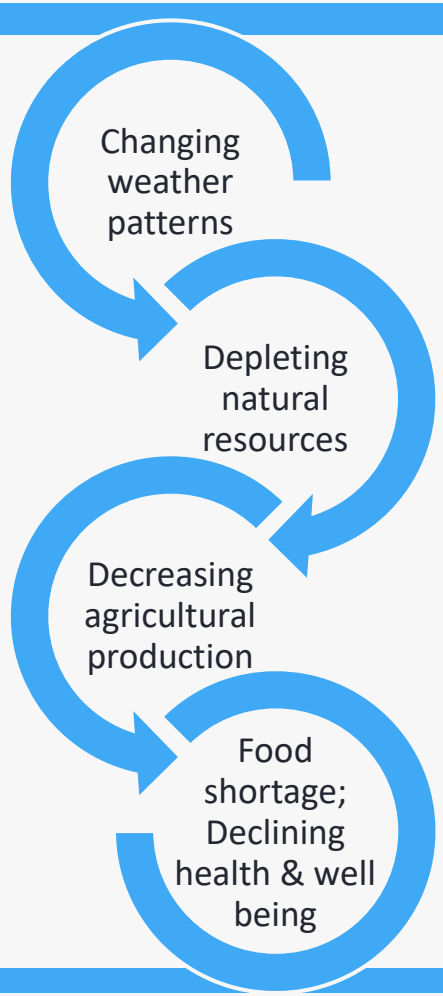
Photo Credit: Juan Silva/The Image Bank via Getty Images

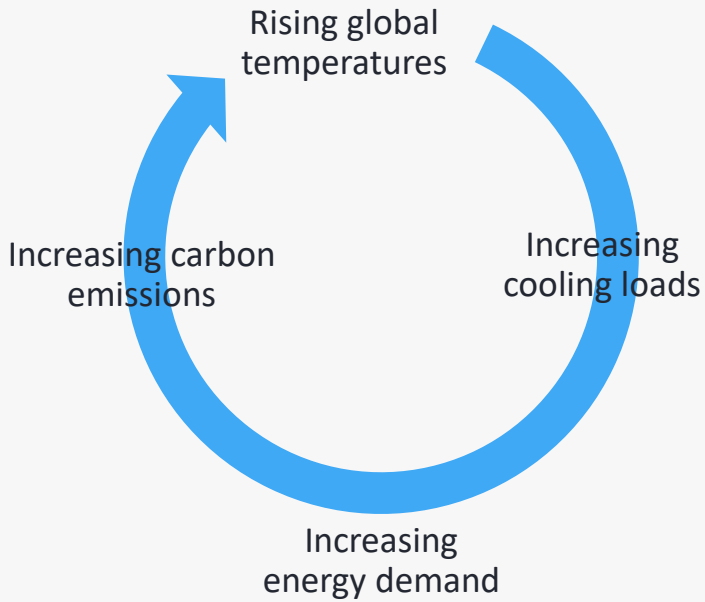
Photo Credit: MUNIR UZ ZAMAN/AFP via Getty Images

Photo Credit: Anadolu Agency/Anadolu Agency via Getty Images

Context
Impacts of Climate Change

- Persistent stresses
  - Long-term impacts on the environment, society and economy
  - Cascading and compounding effects





Context
Impacts of Climate Change

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- Worst impact on the underserved, marginalized and vulnerable communities

Lack resources to withstand and recover due to:

  - Ethnic and racial discrimination
  - Low socioeconomic status
  - Disadvantaged background
  - Location in impoverished areas
  - Age, illness or disability

Photo Credit: Thomas Lohnes/Getty Images News via Getty Images

Photo Credit: Yoshinori Kuwahara/Moment via Getty

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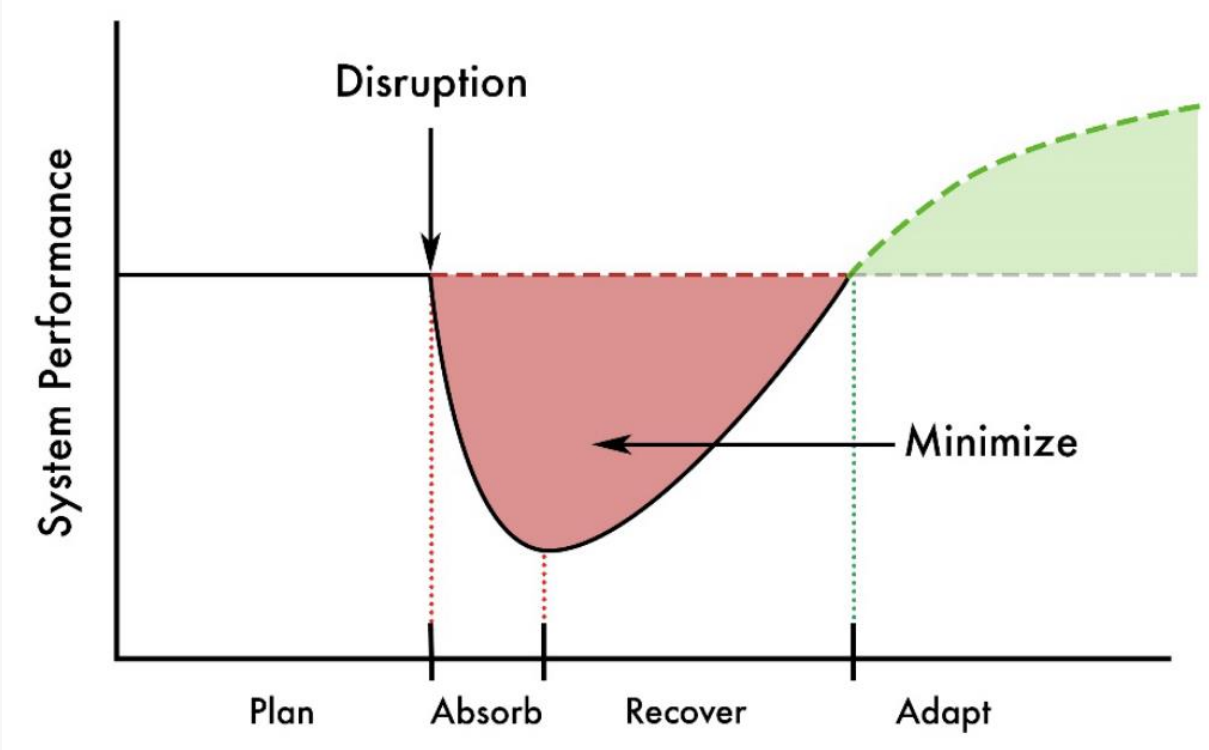
Motivation

Resilient and **sustainable** buildings, communities and infrastructure can respond better to both extreme weather and persistent stresses, and help disadvantaged communities recover from the impacts of climate change.

Resilience

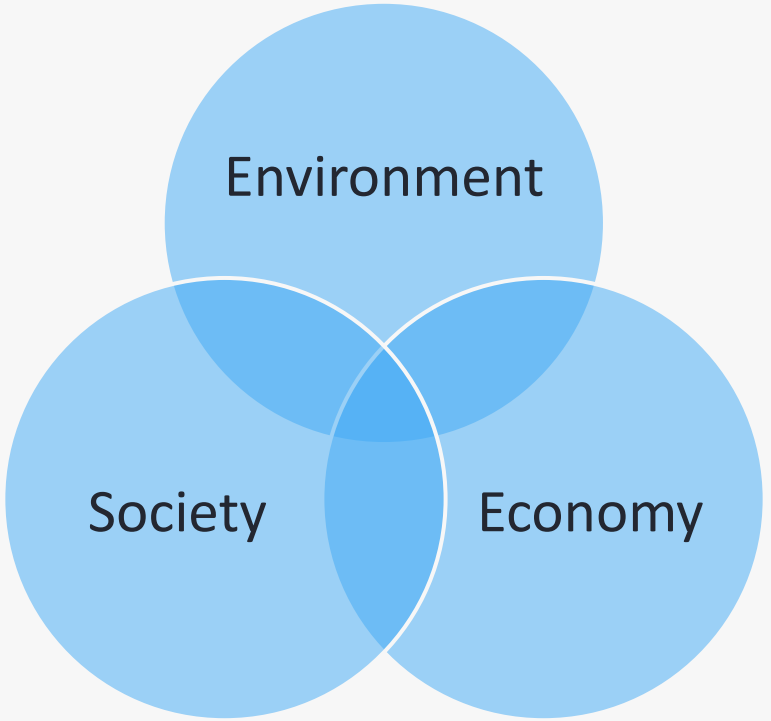
- Ability to adapt to, persist during, and rapidly recover from a disruptive event



Source: https://www.oecd.org
Linkov, I., Trump, B.D., & Hynes, W. (2019). Resilience Strategies and Approaches to Contain Systemic Threats.

Sustainability

- Ability to meet current needs without compromising the needs of future generations



Integrating Resilience and Sustainability

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Opportunities | Contributing Objectives

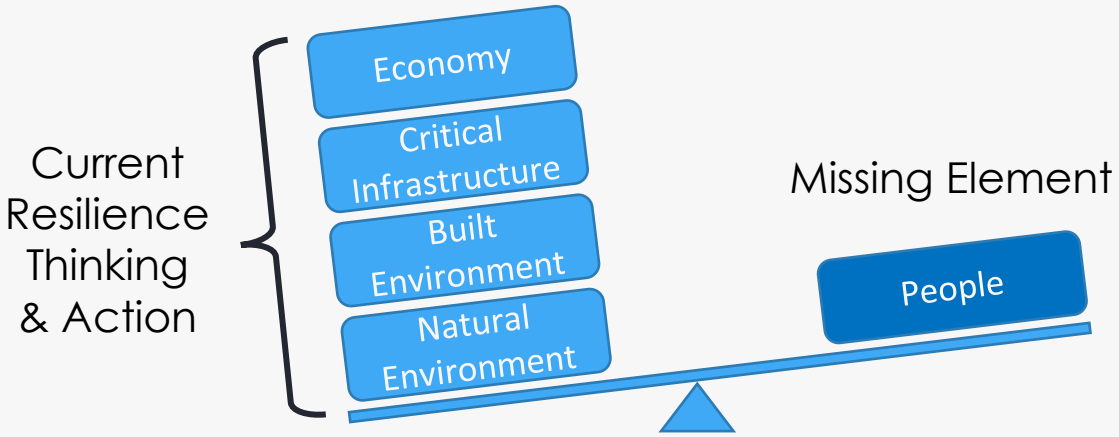
- Resilient systems can better achieve and maintain sustainable operation.
- Sustainable systems lose less critical functionality and can recover more quickly from disturbances.

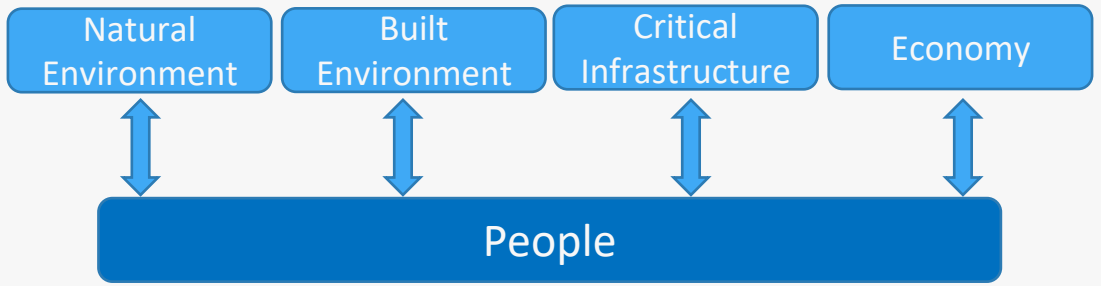
Challenges | Competing Objectives

- Resilience is response to *low-probability, high-impact events*
- Sustainability is response to *high-probability events with long-term impacts*

…and Equity

- Account for the **social distribution** of the impacts of climate change





Equity should NOT be an afterthought, *or* a box to check

Adapted from: Martin, Atyia. "Boston's Resilience Strategy: Resilience and Racial Equity," YouTube, uploaded by GBH Forum Network, September 16, 2016, https://www.youtube.com/watch?v=sZA1Dk6iCFc

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The Challenge

The challenge asks students to develop novel technical solutions to improve the resilience and sustainability of the built environment and identify ways to enable underserved communities to adapt, persist, and recover from extreme weather and persistent stresses caused by climate change.

Additional Resources

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Building Resilience

- https://www.wbdg.org/resources/hazard-specific-building-resilience-considerations
- http://www.cplusga.com/wp-content/uploads/2016/06/enterprise-manual.pdf
- https://www.cityofboston.gov/images_documents/Building_Resilience_in_Boston_FINAL_tcm3-40185.pdf
- https://archplan.buffalo.edu/content/dam/ap/PDFs/NYSERDA/Climate-Resilience-Strategies-for-Buildings.pdf

Community Resilience

- https://www.epa.gov/smartgrowth/creating-equitable-healthy-and-sustainable-communities
- https://www.boston.gov/sites/default/files/file/document_files/2017/07/resilient_boston.pdf
- https://resilientcitiesnetwork.org/communities/resilient-recovery/

Infrastructure Resilience

- https://rmi.org/our-work/buildings/pathways-to-zero/grid-integrated-energy-efficient-buildings/
- https://www.energy.gov/eere/femp/distributed-energy-resources-resilience

Additional Resources

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Case Studies

- https://www.wbcsd.org/Programs/Cities-and-Mobility/Sustainable-Cities/Blueprint-for-a-sustainable-built-environment/Case-studies
- https://www.worldgbc.org/

LEED on Sustainability and Resilience

- https://www.usgbc.org/leed/why-leed
- https://www.usgbc.org/about/priorities/resilience

Toolkits for Design and Assessment for Resilience

- https://toolkit.climate.gov/
- https://www.usgbc.org/sites/default/files/2018-USGBC-Resilience-Brief-041118.pdf
- https://www.climate.gov/maps-data/dataset/future-climate-projections-graphs-maps

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Thank You

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