CIHAN UNIVERSITY-ERBIL
Department of Architectural Engineering

# RESILIENCE TO CLIMATE CHANGE

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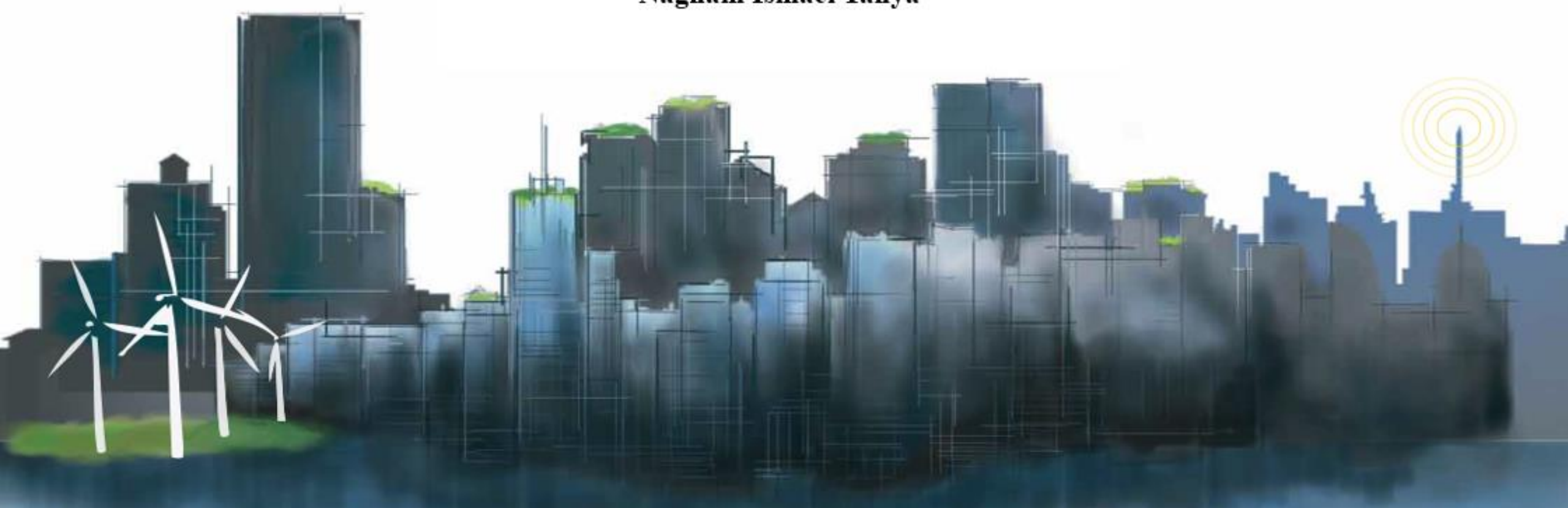

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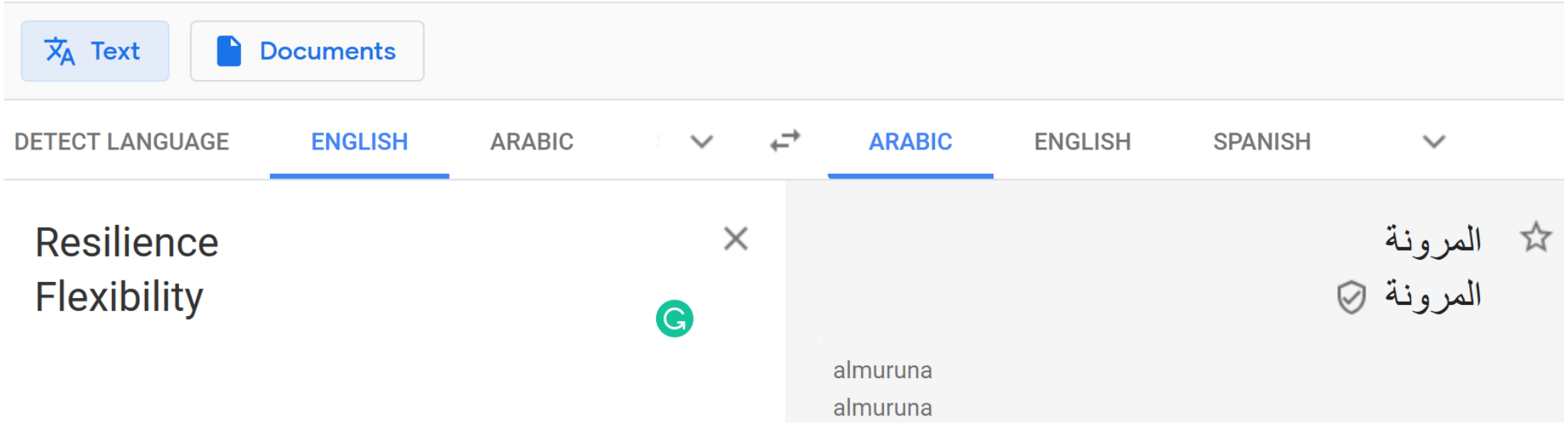
# What does Resilience term mean?



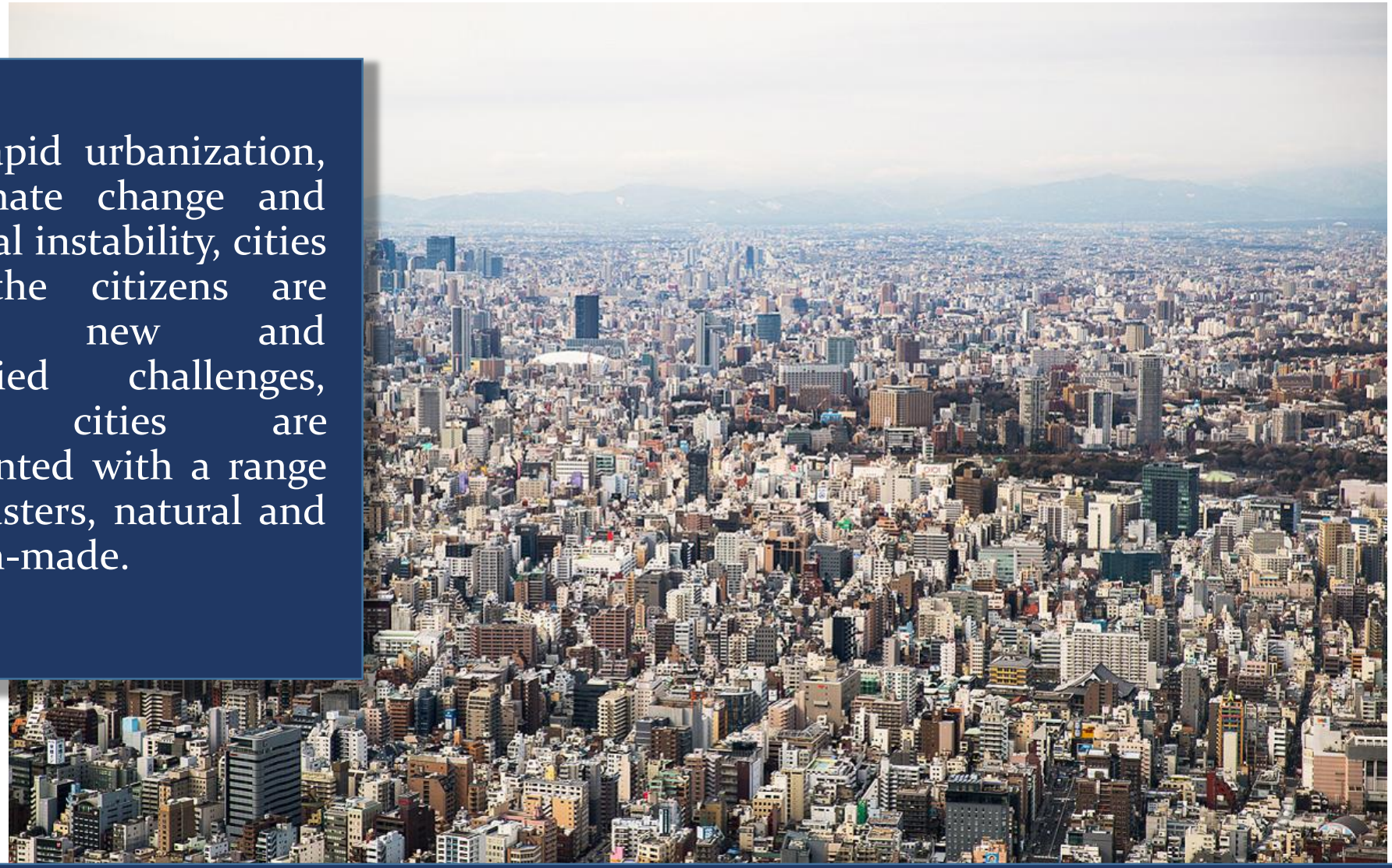
# Flexible VS Resilient

**Flexible** applies to whatever can be bent without breaking

**Resilient** : The ability to spring back into shape after being bent or compressed.

# Resilience as an urban action toward shocks and stresses natural and human-made

The rapid urbanization, a climate change and political instability, cities and the citizens are facing new and amplified challenges, most cities are confronted with a range of disasters, natural and human-made.



According to a study by the United Nations, almost 890 million people across the globe live in cities that are at risk from at least one major natural disaster .And because cities are incredibly complex and dense—with a labyrinth of urban systems like transportation, water supply, sanitation, housing, etc—they are the most liable to destruction from natural disasters.

# Natural disasters impacts on buildings

## Earthquakes

The shaking of the ground during an earthquake loosens the supporting structure to the extent that a building may even collapse.

## Flooding

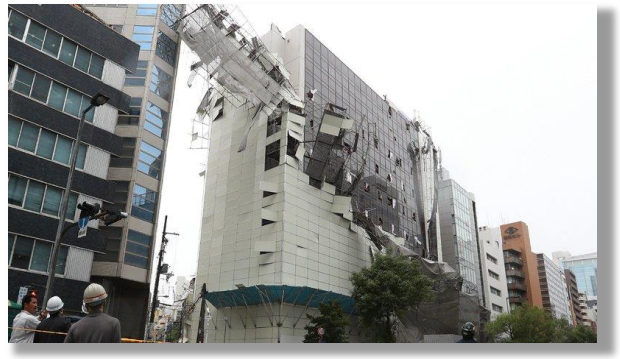
The effects of flooding on a building can include significant damage to materials, services and structure

## Fire

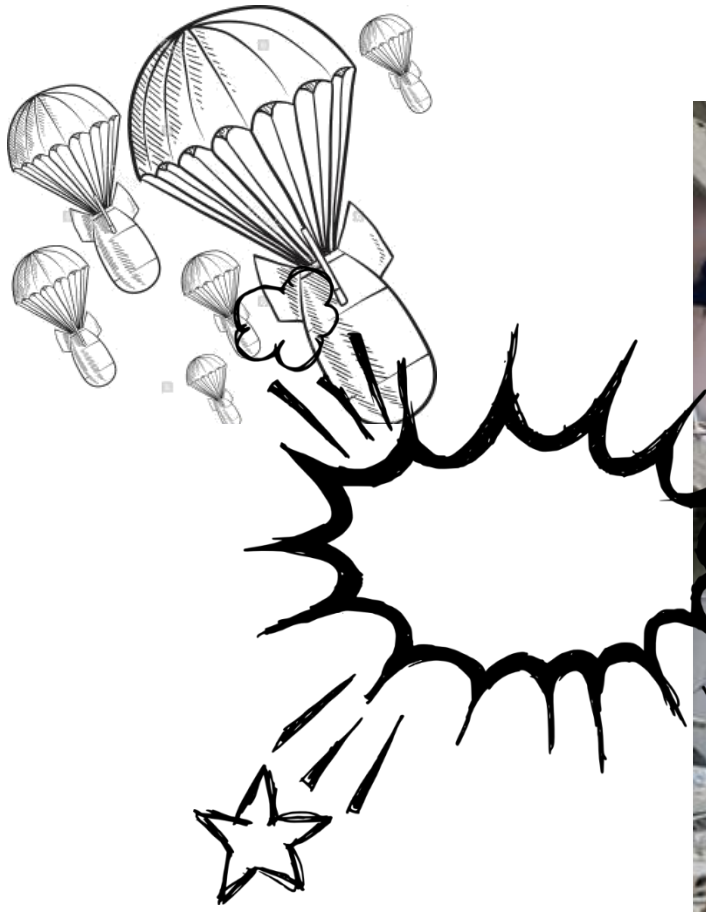
is a disaster that is not always caused by a natural phenomenon. It is natural only if it is caused by lightning or some other natural process.

## Strong Wind

buildings can be damaged by strong wind when the construction materials and technology are inappropriate.



# Human- made disasters



In order to cope with these numerous challenges, the global community is increasingly realizing that we need to build resilience into our cities.

Adaptation Affordable housing Apocalypse Backup Power Batteries Boston Cities Clean water climate change Commercial/Public buildings Communities/Cities composting toilets Disease Droughts Energy efficiency/Renewables Events/Learning flooding Floodproofing Food systems generators heat wave Homeless Homes/Living spaces hurricane India LEED News Passive Survivability Passive warming/cooling Power Grid Power interruption power outage Prepper Rainwater harvesting Sea-level sea-level rise solar Storms Structural strength Survivability Survivalism

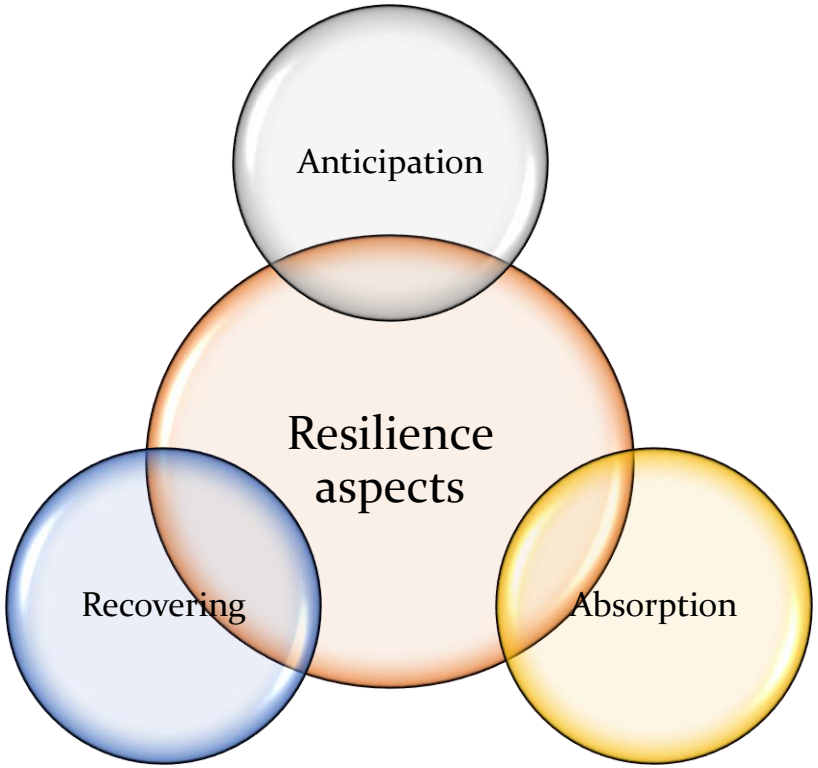
According to the Intergovernmental Panel on Climate Change (IPCC) in USA the resilience is:

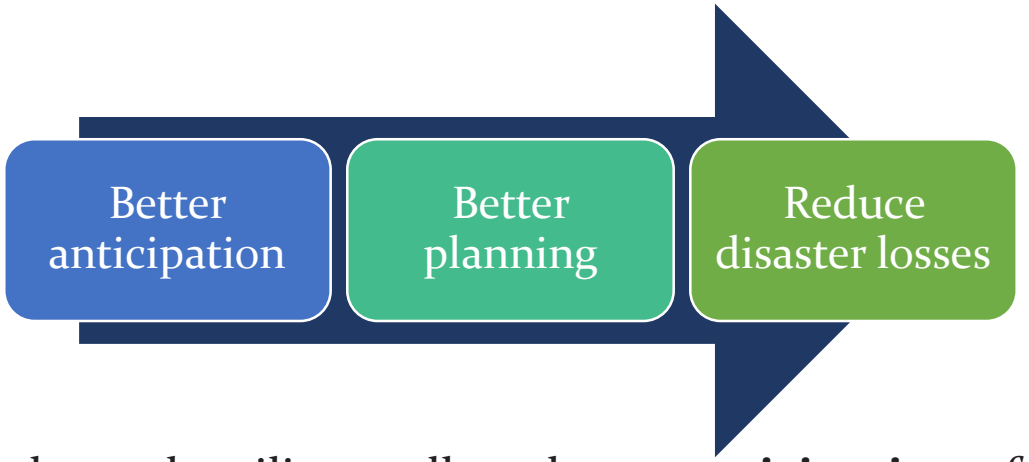
"the ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration or improvement of its essential basic structures and functions".

**Anticipation** : expect emerging conditions and uncertain futures to prepare and plan for reduce disaster losses. (Adaptation to a changing)

**Absorption:** reducing the impacts of the disasters

**Recovering** :Return to the initial stuts




Enhanced resilience allows better **anticipation** of disasters and better planning to reduce disaster losses—rather than waiting for an event to occur and paying for it afterward.

The resilience theory reflects a focal shift from taking action to prevent climate change to a tacit acknowledgment that the effects of climate change are now unavoidable, and that considering the causal role of human behavior in climate change, the degree and types of impact are uncertain.

Rejection

Taking action to prevent climate change

Coexistence

tacit acknowledgment that the effects of climate change are now unavoidable.

Anticipating and preparing for what is to come.

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In recent years there have been many different uses of the terms sustainability and resilience, with some framing sustainability and resilience as the same concept, and others claiming them to be entirely different and unrelated.

**Jeffrey Dugan, AIA, principal at Dattner Architects, New York City:**

***Since most of our work is in the public realm we have always considered resilience in design. Building design and material selection for public buildings must be resilient not only to resist the forces of nature but also to accept the intensity of use. Longer building life is a more sustainable built environment, i.e. resiliency = sustainability.***

**Robin Guenther, FAIA, LEED Fellow, principal, Perkins+Will, New York City**

***Resilient design recognizes that our world is an interconnected, changing place. Design is a systems-based problem-solving tool. Resilient design strives for environmental, social and economic sustainability with the ability to adapt to known and unknown risks and vulnerabilities. Negative impacts are reduced now and in the future by the choices we make.***

**Greg Mella, FAIA, LEED AP BD+C, vice president at SmithGroupJJR , Washington, D.C.**

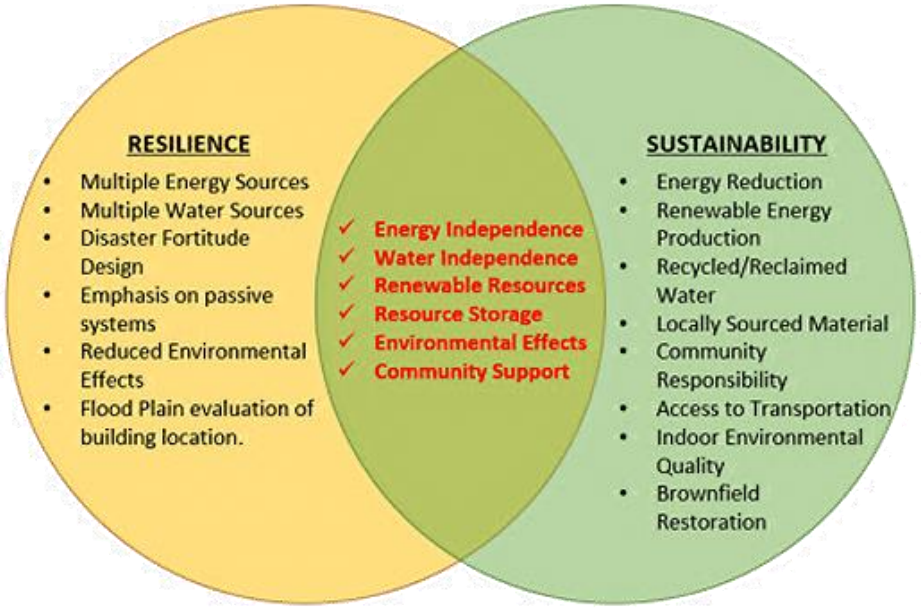
***While sustainability seeks to maintain our balance with the environment, resiliency seeks to maintain the durability and integrity of our communities by designing with consideration to the changing landscape that results from climate change***

**Alex Wilson, president of the Resilient Design Institute, Brattleboro**

***Relative to my long-term focus on sustainability, resilient design provides a motivation to create buildings that are more sustainable. With resilient design, for example, we may create highly energy-efficient buildings that will maintain habitable conditions in the event of an extended power outage, those buildings will keep occupants safe, but they will also minimize environmental impacts.***

| Concept | Sustainability | Resilience |
|---|---|---|
| ***Background*** | Forest Management. Example: 18th century Germany. | Psychological Resilience: the ability to bounce back from a stressful or adverse situation. Theoretical basis developed in the United States in the 1950s. |
| ***Objective*** | To maintain the overall natural resource base. | To make systems flexible enough to deal with changes without changing their principle character. |
| ***Definition*** | Premise: Everything that we need for our survival and well-being depends, either directly or indirectly, on the natural environment. Process: To create and maintain the conditions under which humans and nature can exist in productive harmony, thereby enabling the fulfillment of the environmental, social and economic requirements of present and future generations. | The ability of a system to respond flexibly to situational changes and negative factors without changing the essential state. |
| ***Trend*** | To enable economic development without damaging the natural resource base. | To stimulate flexibility, adaptability and risk-preparedness in order to deal with sudden or long term changes. |

The issues involving Resilience are more tangible (Serve storms pounding the eastern seaboard, flooding coastal communities, mobilizing transportation networks.....)

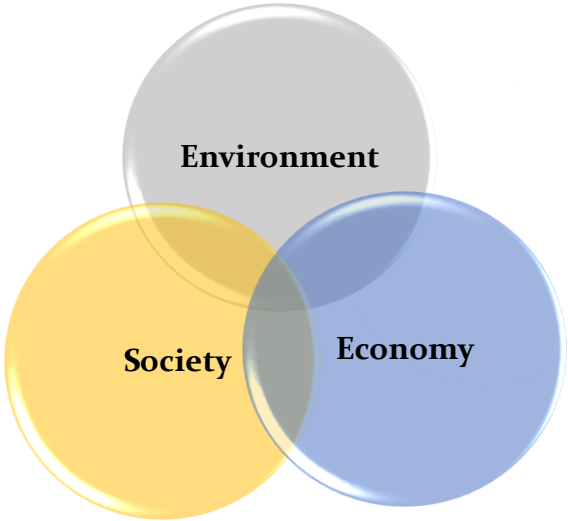



The issues involving Sustainability are Intangible and invisible (greenhouse gases)


*Resilience and sustainability are linked but not **equivalent***

Systems that are not sustainable are ultimately not Resilient.

Resilient Systems are sustainable



**Resilience exceeds scales.** Strategies to address resilience apply at scales of individual buildings, communities, and larger regional and ecosystem scales; they also apply at different time scales—from immediate to long-term.

# Resilient systems provide for basic human needs.

- Potable water
- Sanitation
- Energy
- livable conditions
- lighting
- Safe air
- Food

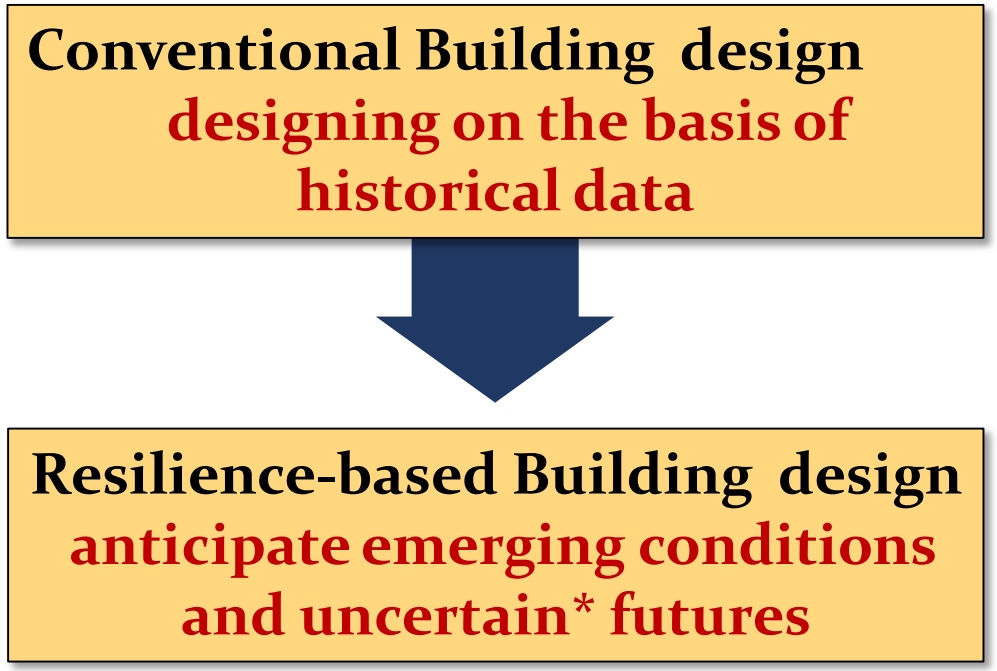
These should be equitably distributed.

# Urban Rresilience

The **Urban Resilience** defined as the measurable ability of any **urban system**, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming towards **sustainability**.

# Building Resilience

Climate considerations have long been integral to building design. But resilience requires a fundamental, shift in perspective; instead of designing on the basis of historical data, it is necessary to anticipate emerging conditions and “uncertain futures.”




*Uncertainty points to the potential relevance of considerations beyond the linear, predictive assessments of conventional risk analysis.

# Resilient Facade

The building façade in its critical role as mediator between nature and the indoor environment—is frequently referenced in the resilience dialogue.

The wind and floodwater brought by severe storms are common resilience considerations.

# Thank you for your attention!