

Resilient Buildings – The Real Sustainability

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A few facts...

- US only developed nation in “Top 10” for both costs of natural disasters and population affected by natural disasters
- Average life of non-residential (non-wood) buildings ~ 80 yrs
- Energy use ~ 20% of the operational cost of a building *BUT* annually only 2% of capital cost
- Resource use of construction >>> annual operations; refurbishment and renovation can be almost as expensive

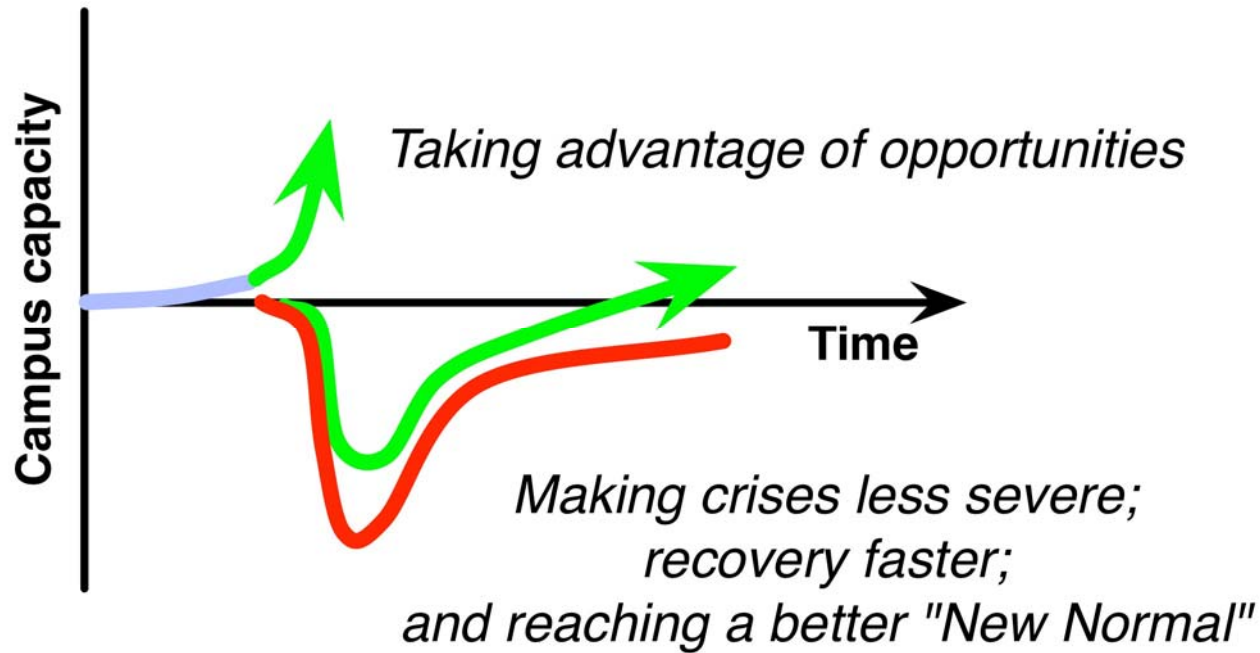
A few more facts...

- This year, ~\$27 B in severe weather damage across US
- Almost exactly 50/50, flood vs wind; but damage due to high wind twice as often
- Debris (unguided missiles) significant risk factor in high winds
- Debris management can account for up to 75% of total costs, particularly for older structures
 - Asbestos, lead, other RCRA metals, PCBs

Even more facts...

- Katrina's impacts on IHEs
 - Tulane: \$650 M; school reorganized
 - Dillard, Xavier, SUNO: \$650 M and ~ 2/3 pre-storm student body
 - Hundreds of faculty "laid off"
- Straight line winds cost MSU \$10 M in repairs
- Flooding from Sandy shut down Verizon for weeks because of server placement in basement

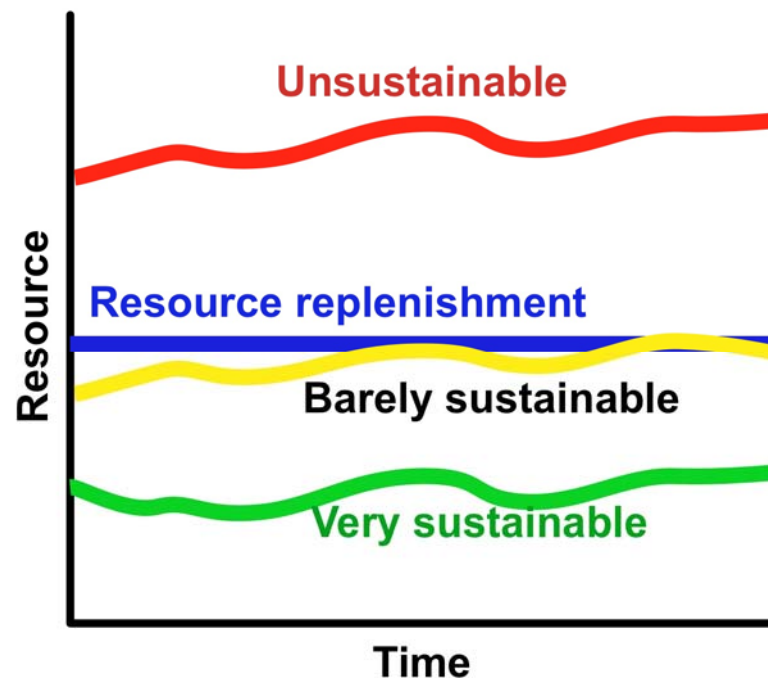
Resilience



- Key components of resilience of buildings
 - Robustness
 - Maintenance
 - Redundancy

Sustainability

- Minimize use of resources over long-term
- Focused on cumulative use of resources, over time, not response to/recovery from shocks
- Thus, efficiency of paramount importance



Corollaries

- Resilience focuses on change; sustainability largely ignores it
- Resilience has to know the context
 - Building only one component of the IHE “system”
 - Sustainability movement just beginning to consider context (e.g., extra credit for siting)

Resilient Buildings

- Resistant to natural hazards
- Protect humans (and assets) from nature
- Aligned with Institution of Higher Education's (IHE's) context
 - IHEs as concentrators of risk
 - Siting, usage and hazards all important

IHE context

- Siting – hazards exposure
- Finance – funding
- Use – accelerating changes in technology and curricula
- Time – aging will occur
- Fitness for use – interdependencies and expectations

Hazards exposure

- Wind – proximity to debris; roof, windows and doors
- Flood – topography; what's upstream
- Winter storm – roof
- Fire – flammability and proximity to “fuel”

Funding

- (Preventive) Maintenance
- Inspections
- Monitoring

Use

- Today's chemistry building may be tomorrow's biology building
- In 25 years, we won't be teaching X the same way we are now (and we may not be teaching X at all!)
- Cost of capital exceedingly low now; unlikely to remain low in long-term
- Value of repurposing

Time

- Materials age; system performance degrades
[NB: no guarantee that projected energy savings from LEED will persist]
- Roofs especially vulnerable
- Monitoring / periodic inspection / PM program essential components of resilience

Fitness for use

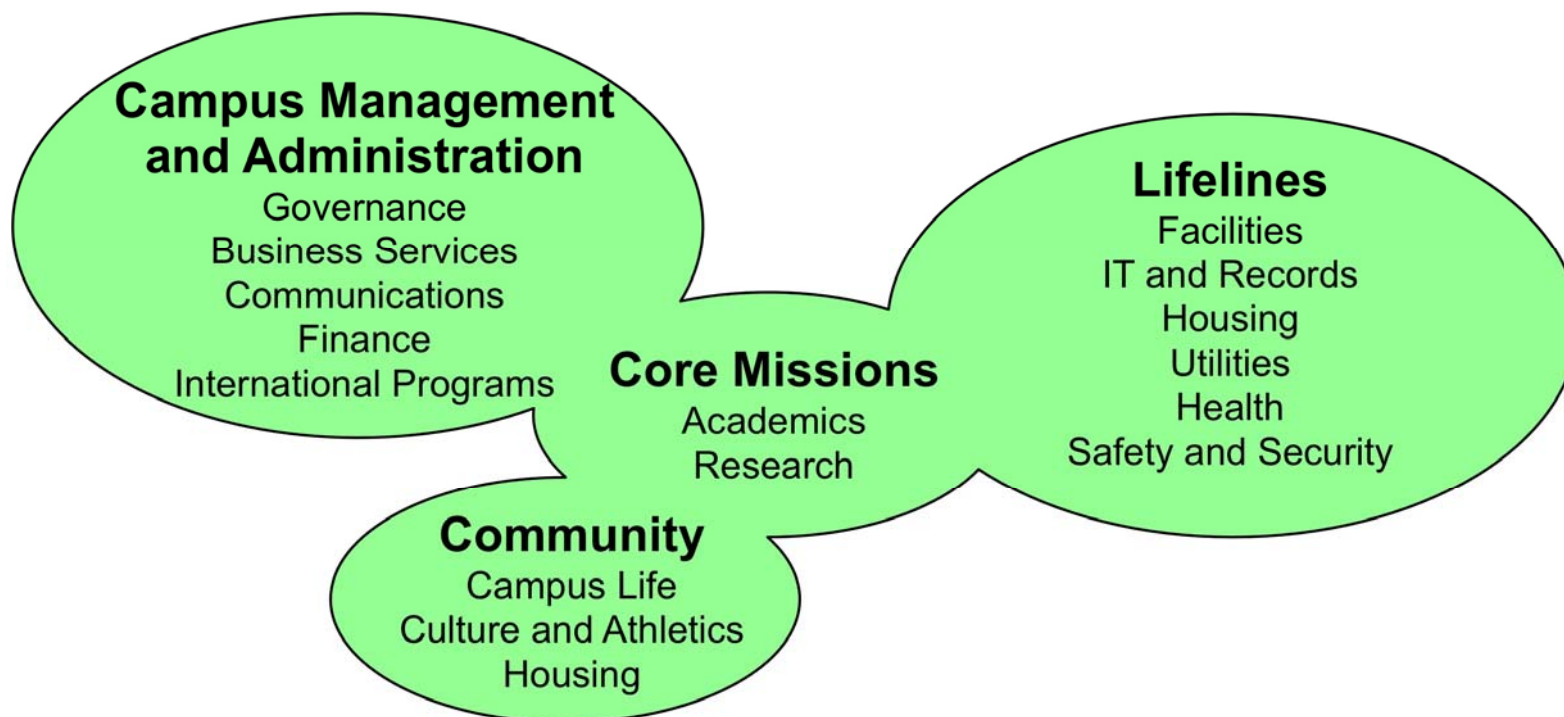
- Depends on interdependencies and expectations
- Have gone from buildings “un-plugged” to wired to fiber optic cable to ?
- Changing expectations of faculty and students (particularly in terms of residences)
- Importance of “adaptability” of buildings

Building blocks for resilient buildings

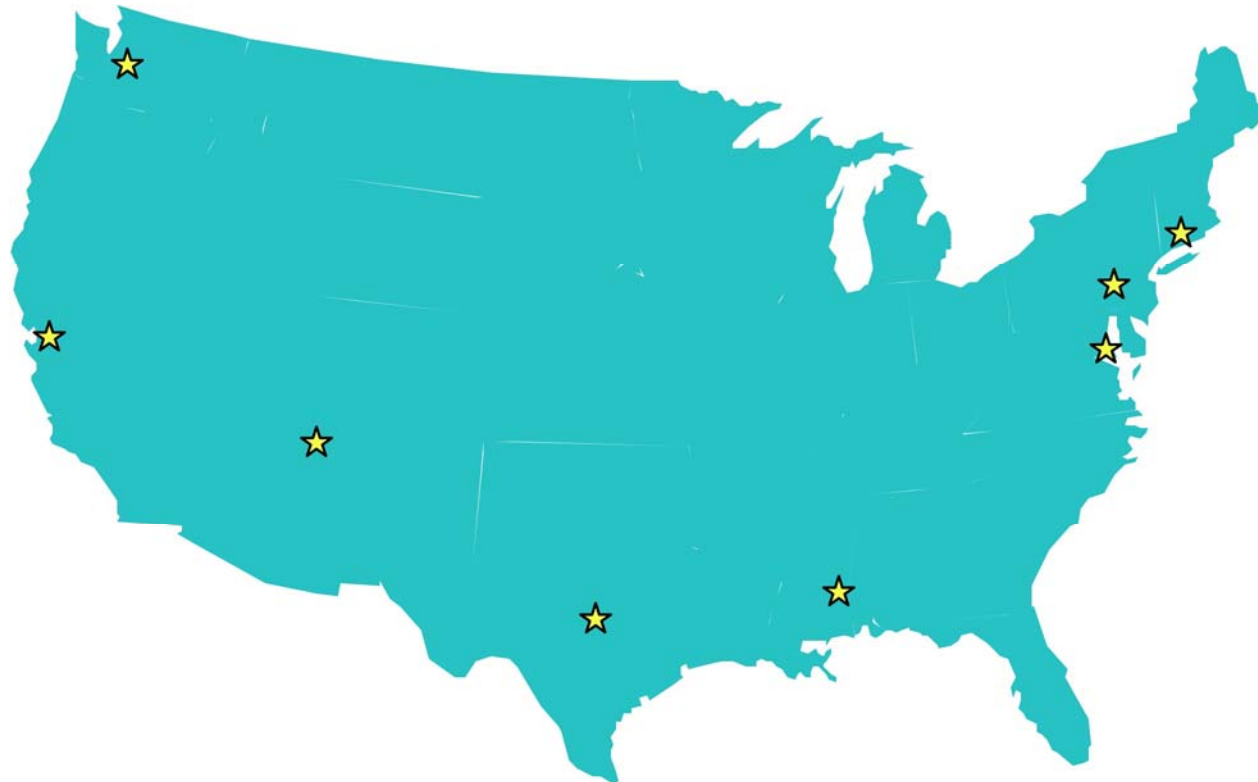
- Hazards assessment (e.g., FEMA THIRA)
- Building codes and building codes +
 - ICC codes
 - IBHS Fortified standard
 - US Storm Shelter Association (FEMA P-320)
- Inspections (roofs; asset placement, e.g., servers; hazardous materials...)
- Monitoring, PM program

Campus Resilience Enhancement System (CaRES)

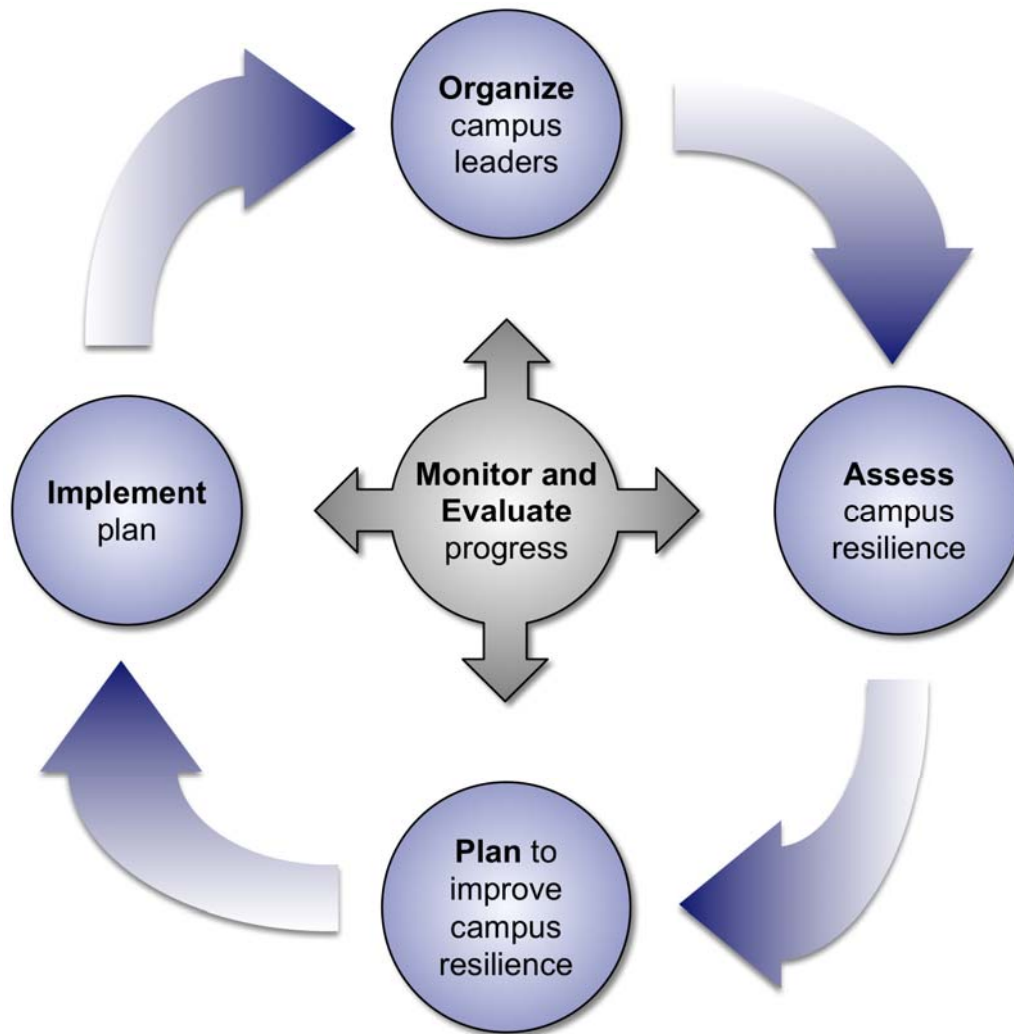
- Developed for Department of Homeland Security
- “Whole of Campus” approach: parses campus into 15 functional areas (CaSAs)



IHEs using / used CaRES



CaRES Process



CaRES Site

Site Actions jplodinec ▾

[CaRES Home](#) [Teams & Groups -](#) [Campus Information & Self Assessment -](#) [Campus Services -](#) [Taking Action -](#) [Exercising & Evaluating -](#)

CaRES Resources

- Community Documents
- Guidance
- Resource Library
- Glossary
- Collaboration
- Toolkits
- Feedback
- FAQs
- Playbooks

Welcome to the Campus Resilience Enhancement System!

CaRES Home

The Campus Resilience Enhancement System (CaRES) provides four modules for helping your Institution of Higher Education (IHE) determine its current state of resilience against potential crises and disasters, and determine how to improve its resilience initially and on an ongoing basis.

The four modules are:

- **Module 1:** Organize Campus Resilience Initiative → [Click Here](#) to begin;
- **Module 2:** Conduct Whole Campus Resilience Assessment → [Click Here](#) to begin;
- **Module 3:** Take Action → [Click Here](#) to begin; and
- **Module 4:** Exercise and Evaluate → [Click Here](#) to begin.

Tips for Success Success Stories Help Me

- 1 Organize Campus Resilience Initiative
- 2 Conduct Whole Campus Resilience Assessment
- 3 Take Action
- 4 Exercise and Evaluate

Legend:

- Completed In Progress
- In Review To Do

Developed by **CRRI** Community & Regional Resilience Institute

Assessment threads

Module 2: Conduct Whole Campus Resilience Assessment Step 1: Campus Service Area Assessments



Tips for
Success



Success
Stories



Help
Me

Campus Service Area Assessments (2 of 3)

The detailed CaSA assessments include questions addressing the following categories:

- **General Resilience** – resilience issues that cut across more than one of crisis categories below as well as issues related to reputational crises, which can compromise an institution's ability to function;
- **Extensive Damage** – natural and technological disasters and some acts of terrorism;
- **Loss of Life, Campus Violence, Social Unrest** – crime, violence, traumatic incidents, and some acts of terrorism;
- **Health Crisis** – illness outbreaks, pandemic, psychological trauma;
- **Economic Crisis** – economic recession, funding cuts, enrollment shortfalls; and
- **Cyber Crisis** – intrusion or cyber attack on information technology systems.

CaRES tailors which assessment questions are posed to the user in each selected CaSA assessment, based upon the significant threats identified by the IHE on the *Risks Worksheet* (e.g., risks scored ≥ 9).


Assessment

- Simple set of yes-no questions answered by campus Subject Matter Experts
- Questions aimed at finding potential strengths, and identifying gaps
- Suggestions for becoming stronger, or to fill gaps the Assessment Team identifies
 - Includes links, pointers to “action aids,” and explanations of importance

Assessment example questions

Facilities, On-Campus Housing and Transportation ×

Assessment

 Save & Exit

Does the campus facilities organization periodically survey the campus community about the appearance and maintenance of campus facilities and desired facility upgrades?

Yes No Comments: ✗ F

Does the campus facilities organization perform preventive maintenance routinely and on a timely basis?

Yes No Comments: ✗ F

Do the campus facilities organization(s) have current and accurate information about the specific locations and types of significant hazards (e.g., hazardous chemicals, energized equipment, powerful magnets, embedded hazards such as asbestos and lead) in all facilities?

Yes No Comments: ✗ F

Conclusions

- Resilient buildings (resistant to disasters; easily adapted to changing needs) should be a key component of campus sustainability
- Building in resilience requires consideration of campus “context”
 - Hazards faced
 - Funding
 - Use
 - Time
 - Fitness for use and adaptability
- CaRES has been developed to help campuses look at their resilience holistically

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