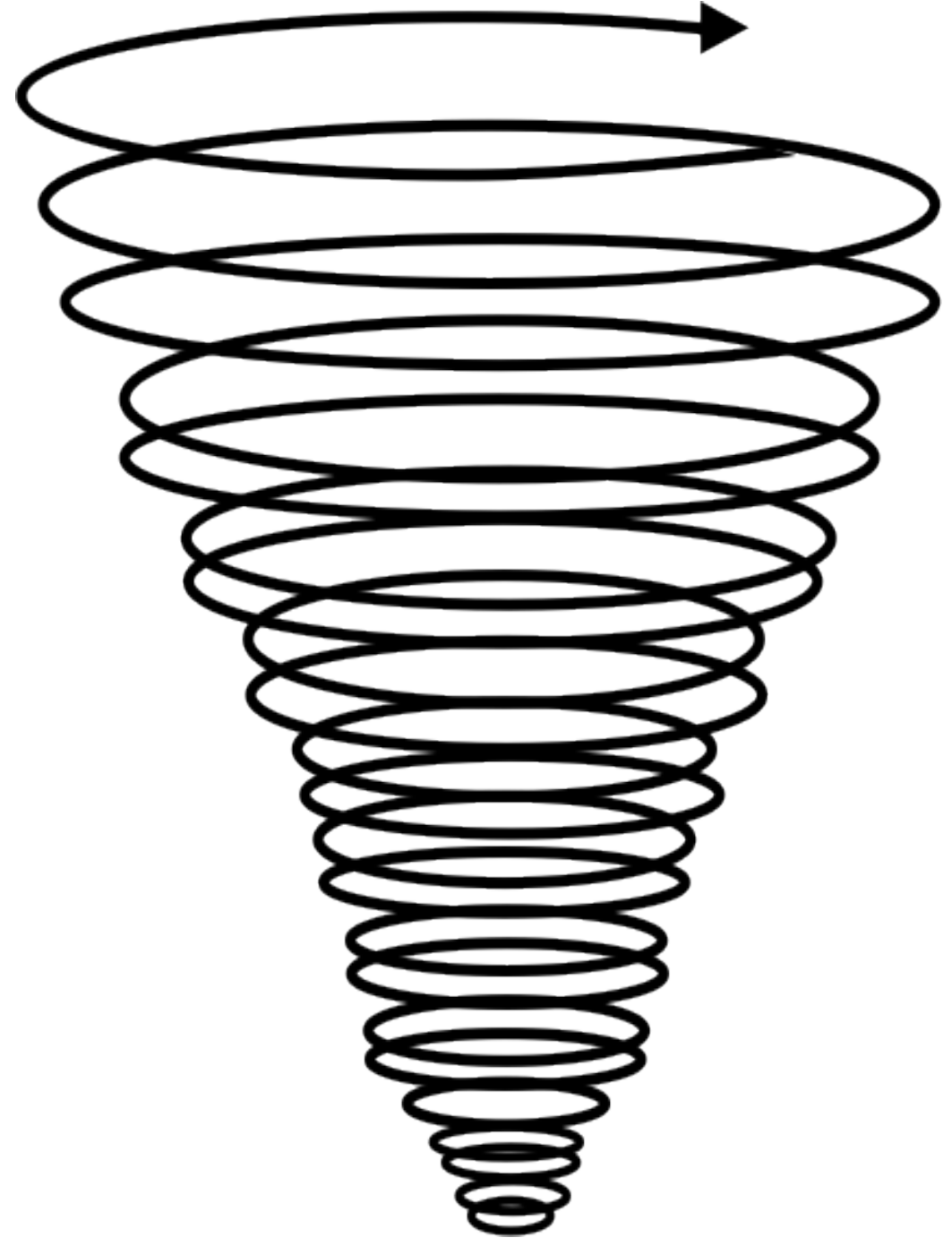


Social Sciences, Natural Hazards Mitigation, and the Built Environment

Lori Peek, Ph.D.

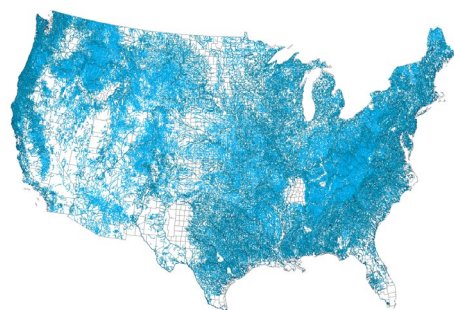
Professor, Department of Sociology and Director, Natural Hazards Center, University of Colorado Boulder
Board Member, National Institute of Building Sciences



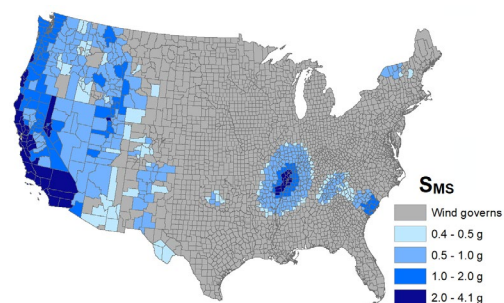
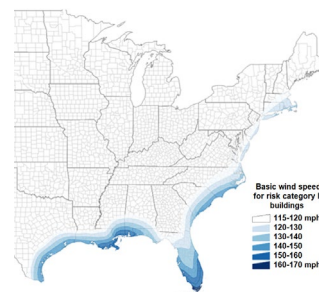


U.S. disaster losses from floods, wind, earthquakes, and wildfires now average **\$100 billion** per year.

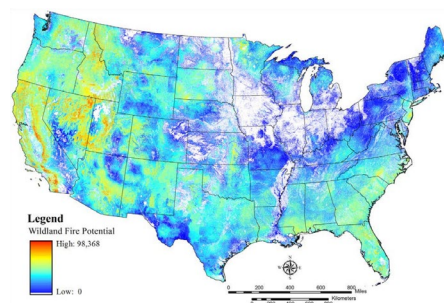
Flood



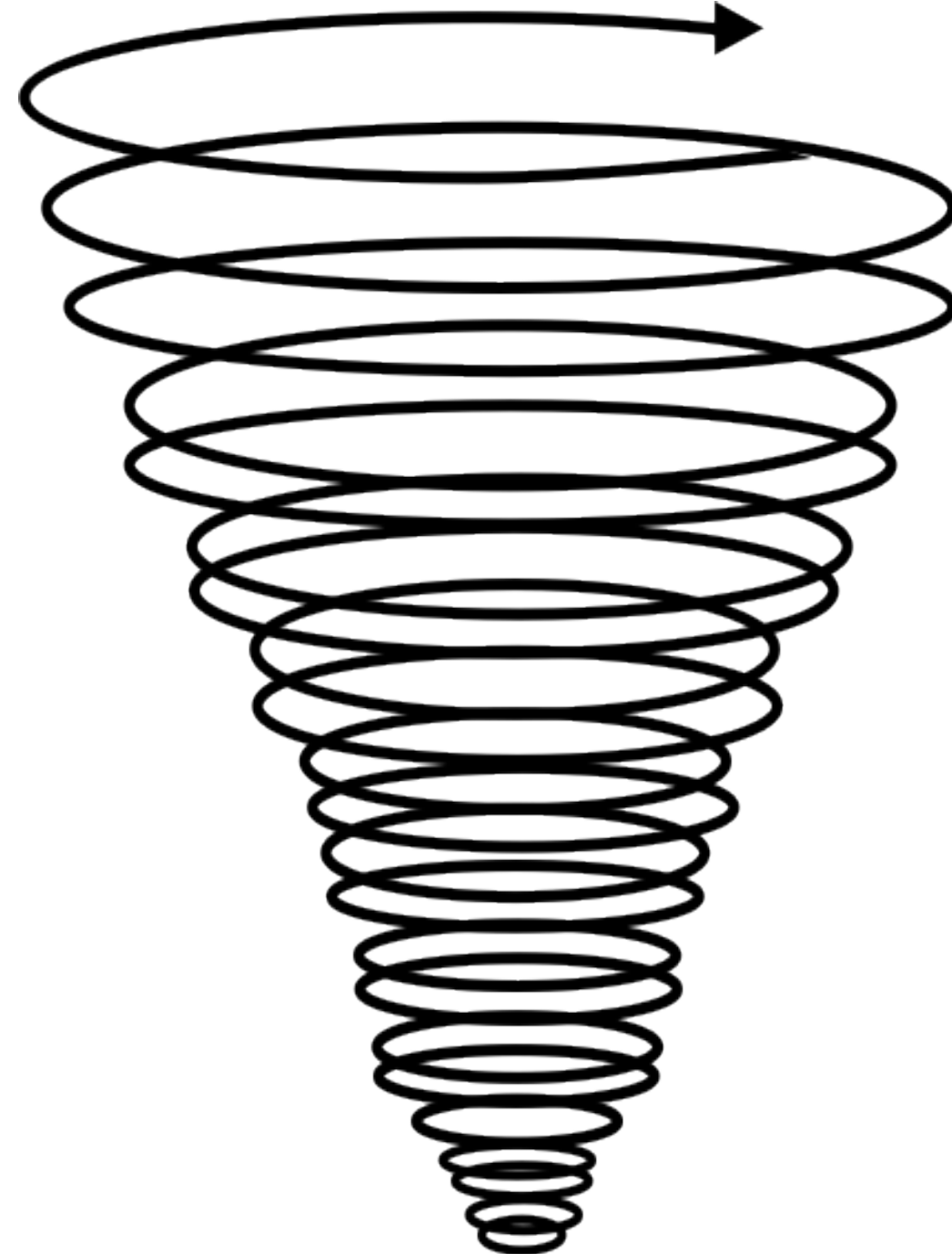
Hurricane



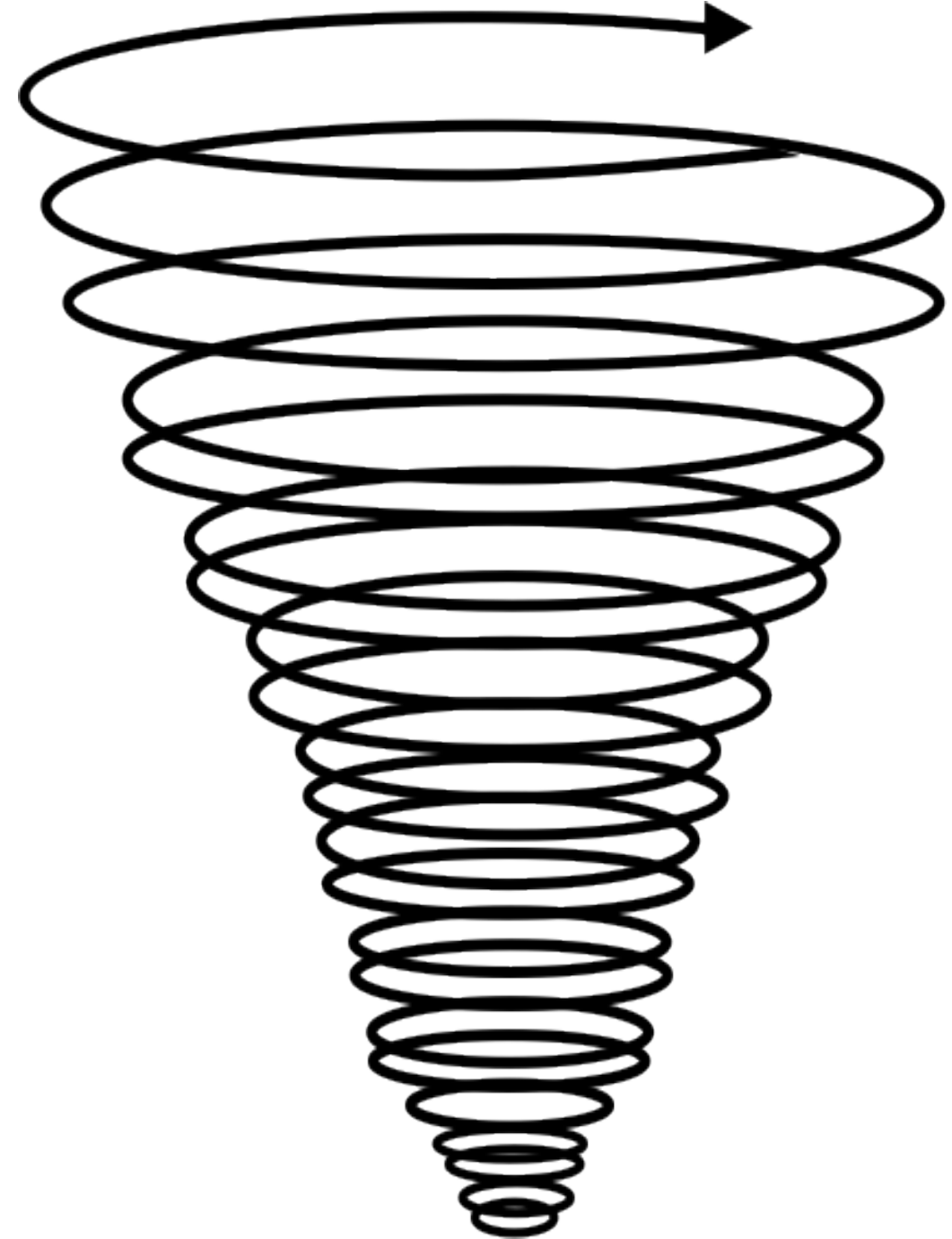
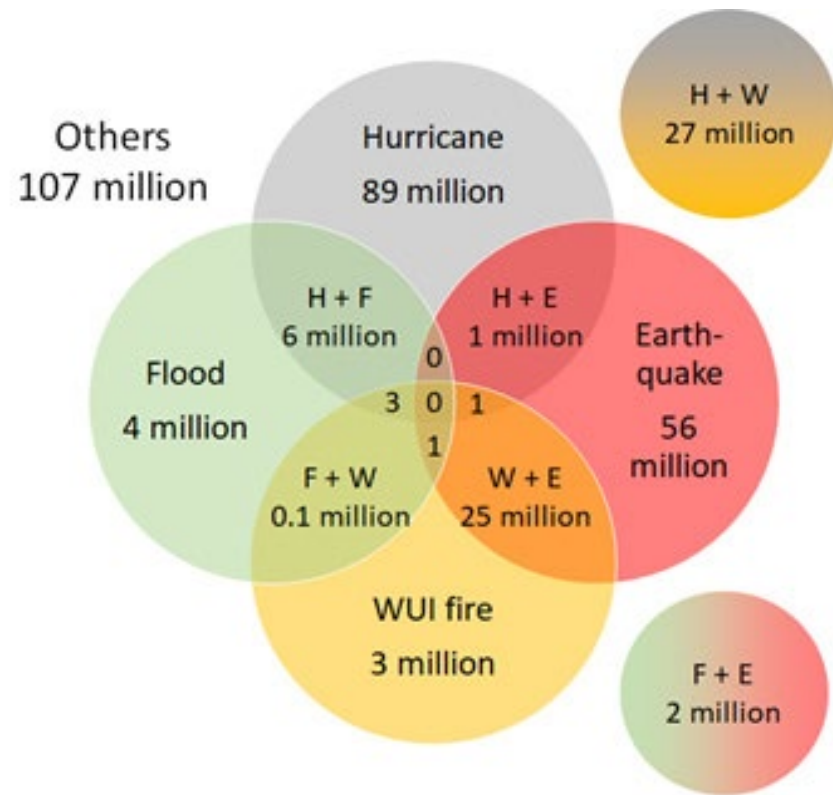
Earthquake



Wildfire



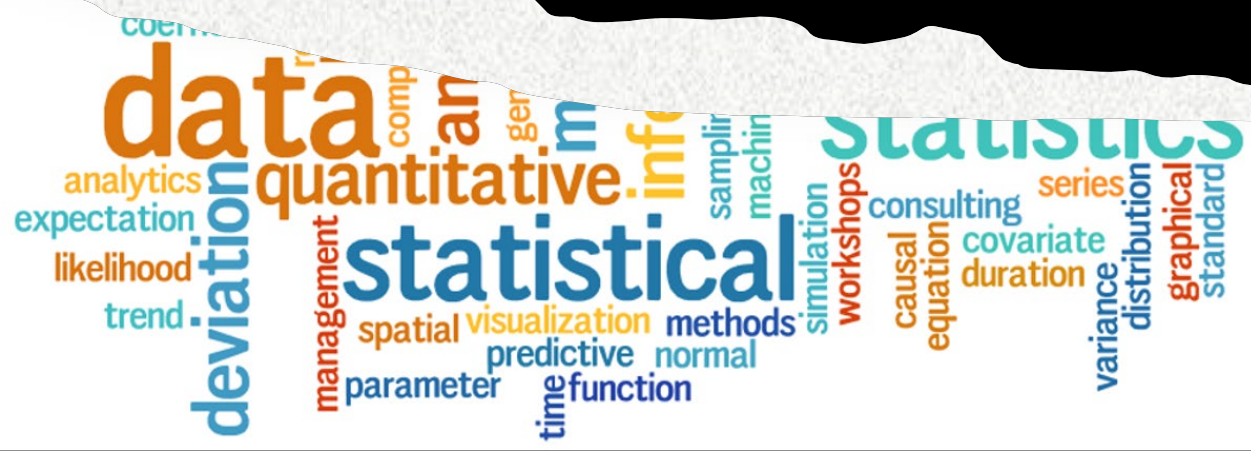
In addition, more people than ever before in the U.S. are exposed to one or more natural hazards













How much does mitigation *actually* save?



How much does mitigation *actually* save?

|  National Institute of BUILDING SCIENCES™ | | ADOPT CODE | ABOVE CODE | BUILDING RETROFIT | LIFELINE RETROFIT | FEDERAL GRANTS |
|---|-------------------------------|-------------------|-------------------|----------------------|----------------------|-------------------|
| Overall Benefit-Cost Ratio | | 11:1 | 4:1 | 4:1 | 4:1 | 6:1 |
| Cost (\$ billion) | | \$1 /year | \$4 /year | \$520 | \$0.6 | \$27 |
| Benefit (\$ billion) | | \$13 /year | \$16 /year | \$2200 | \$2.5 | \$160 |
|  | Riverine Flood | 6:1 | 5:1 | 6:1 | 8:1 | 7:1 |
|  | Hurricane Surge | not applicable | 7:1 | not applicable | not applicable | not applicable |
|  | Wind | 10:1 | 5:1 | 6:1 | 7:1 | 5:1 |
|  | Earthquake | 12:1 | 4:1 | 13:1 | 3:1 | 3:1 |
|  | Wildland-Urban Interface Fire | not applicable | 4:1 | 2:1 | not applicable | 3:1 |

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How much does mitigation *actually* save?

“Disaster researchers have not yet produced a systematic method to quantify all losses that occur in a disaster...

Disasters **disconnect people** from friends, schools, work, and familiar places. They **ruin family photos** and **heirlooms** and **alter relationships**. Large disasters may cause permanent **harm to culture** and **one's way of life** and impact the most **socially and financially marginal people**.

Disasters may have **long-term consequences** for **health** and **collective wellbeing**. These events also often **hurt and kill pets** and **destroy natural ecosystems** that are integral parts of communities.

Disasters clearly **disrupt life's arc** in ways that are hard to express, let alone assign monetary worth. Even the potential for future disasters affects people's **peace of mind**.


Mitigation saves more than is estimated in this report” (p. 304).



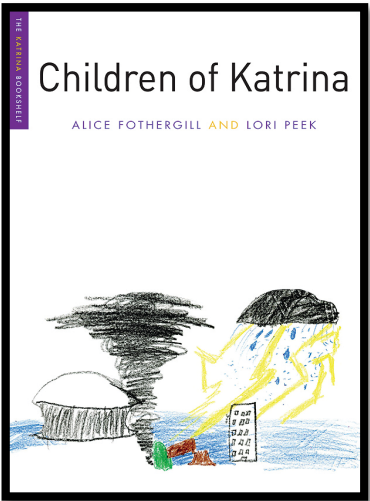
University of Colorado Boulder

<https://www.nibs.org/projects/natural-hazard-mitigation-saves-2019-report>

How much does mitigation *actually* save?

| | | | | | | |
|---|--|----------------------------|-----------|----------------|----------------|----------------|
|  National Institute of BUILDING SCIENCES™ | | Overall Benefit-Cost Ratio | | | | |
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University of Colorado Boulder

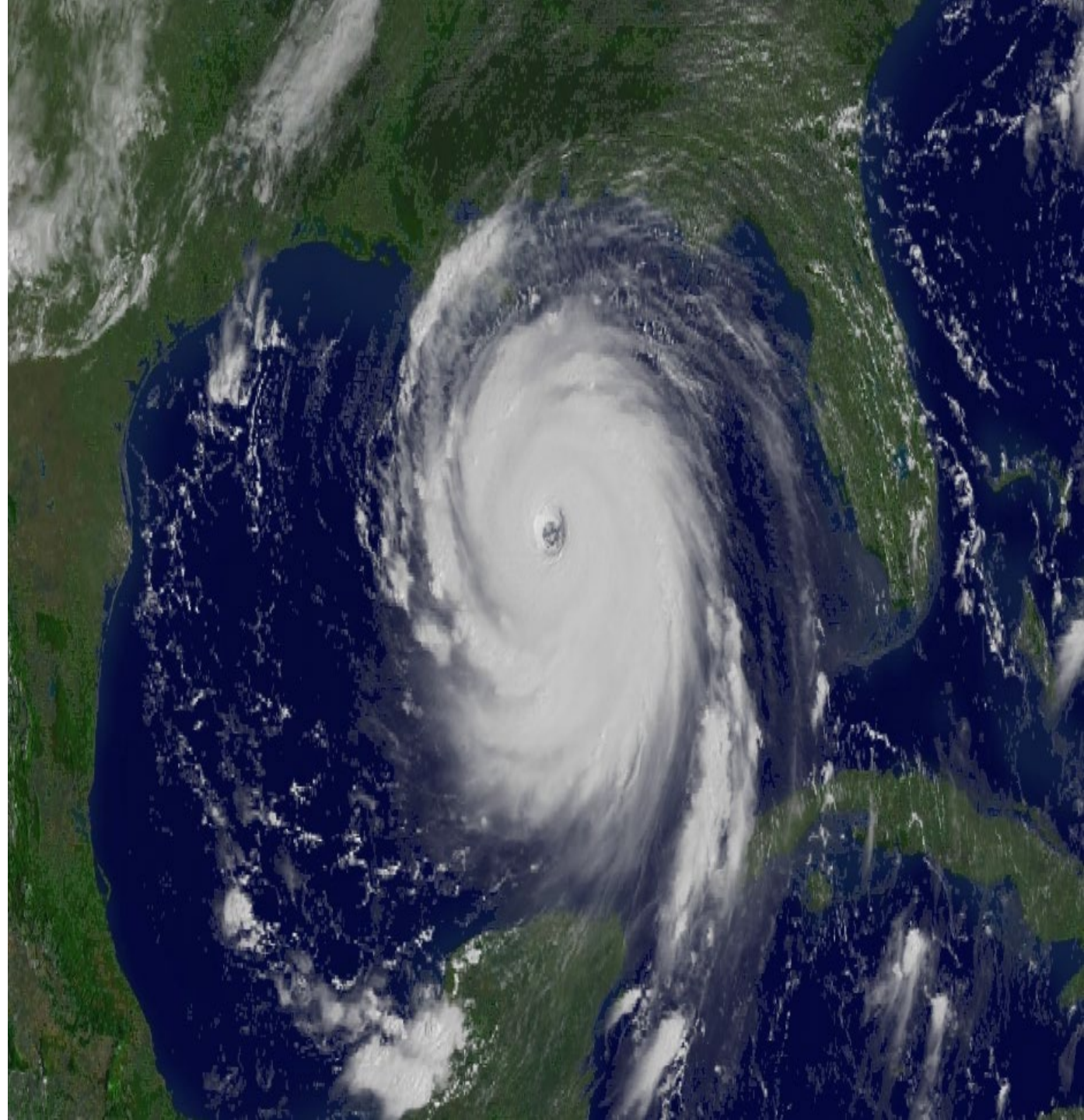


*“Since Katrina, we
been having it hard,
even since before
Katrina, going from
pillar to post, shelter
to shelter, stuff like
that.”* –Daniel, 12 years old



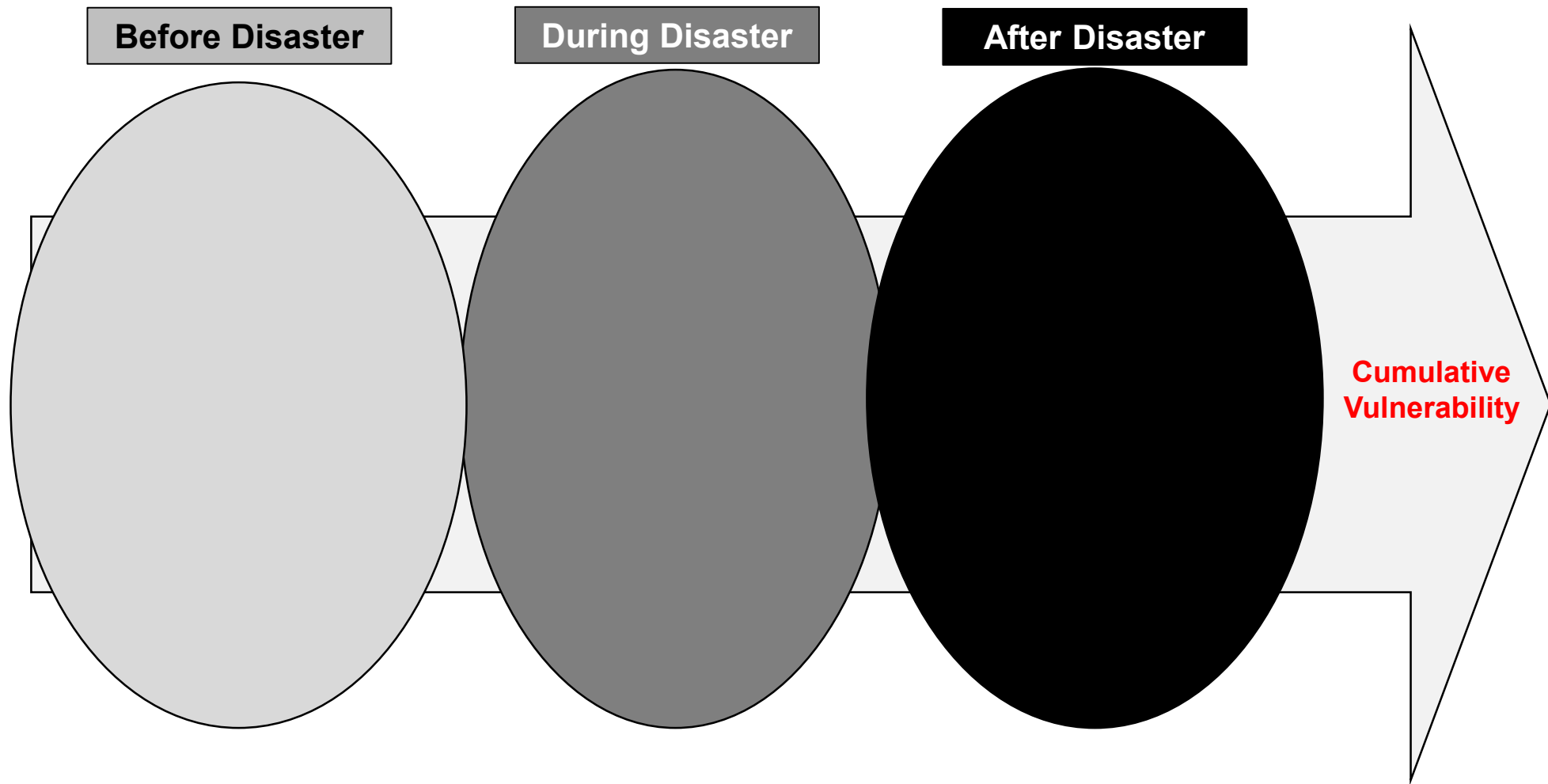
“The night before [Katrina], it was raining and so stormy, I thought it was just another storm... something like Tropical Storm Cindy. We survived Cindy before Hurricane Katrina. I went to sleep that night, and something just didn’t feel right, so I said, ‘Mama, why don’t we get up and move to the back room, put the mattress in the back room?’ Because that’s the safest place in the house.”

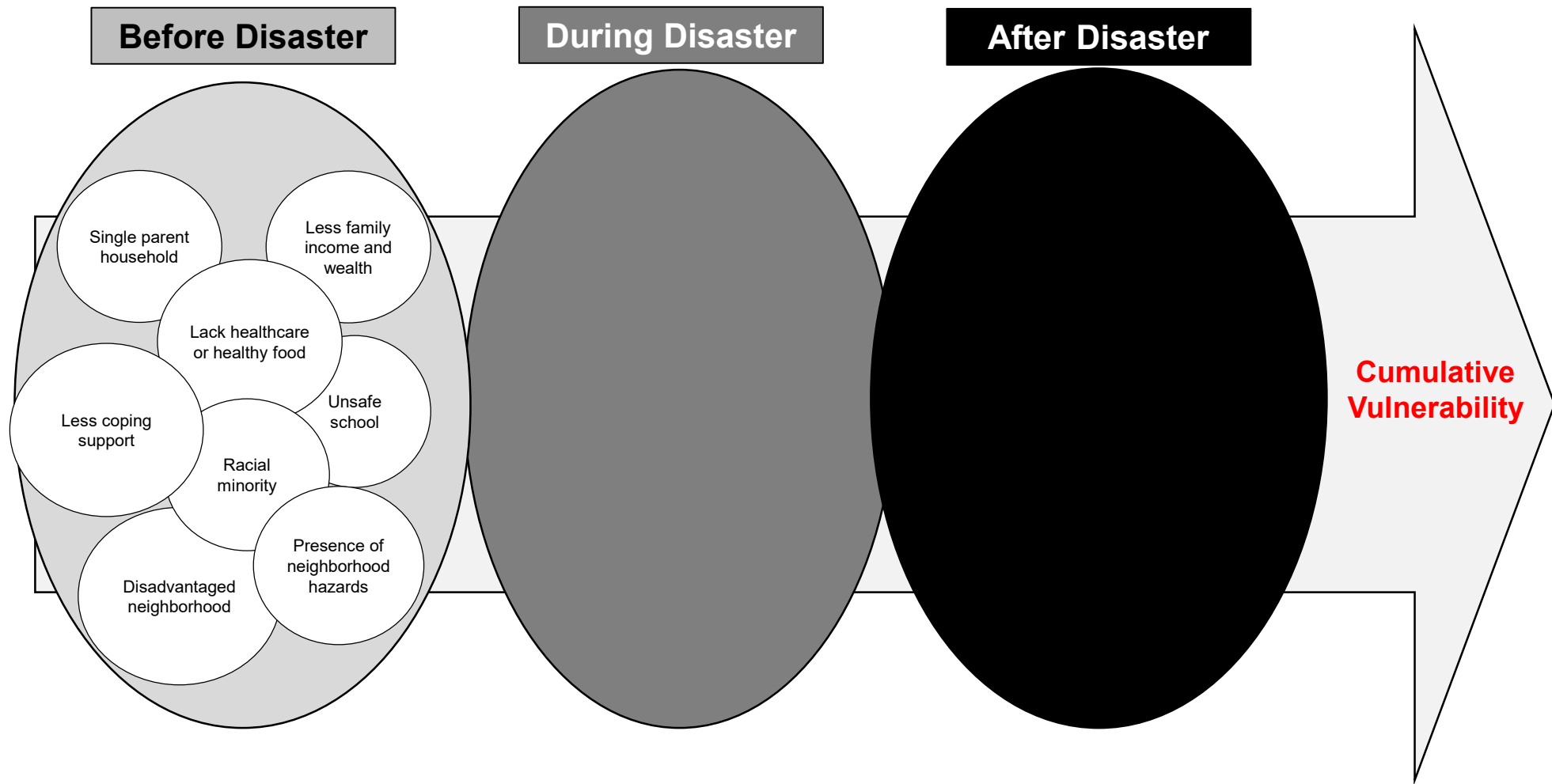
—Daniel

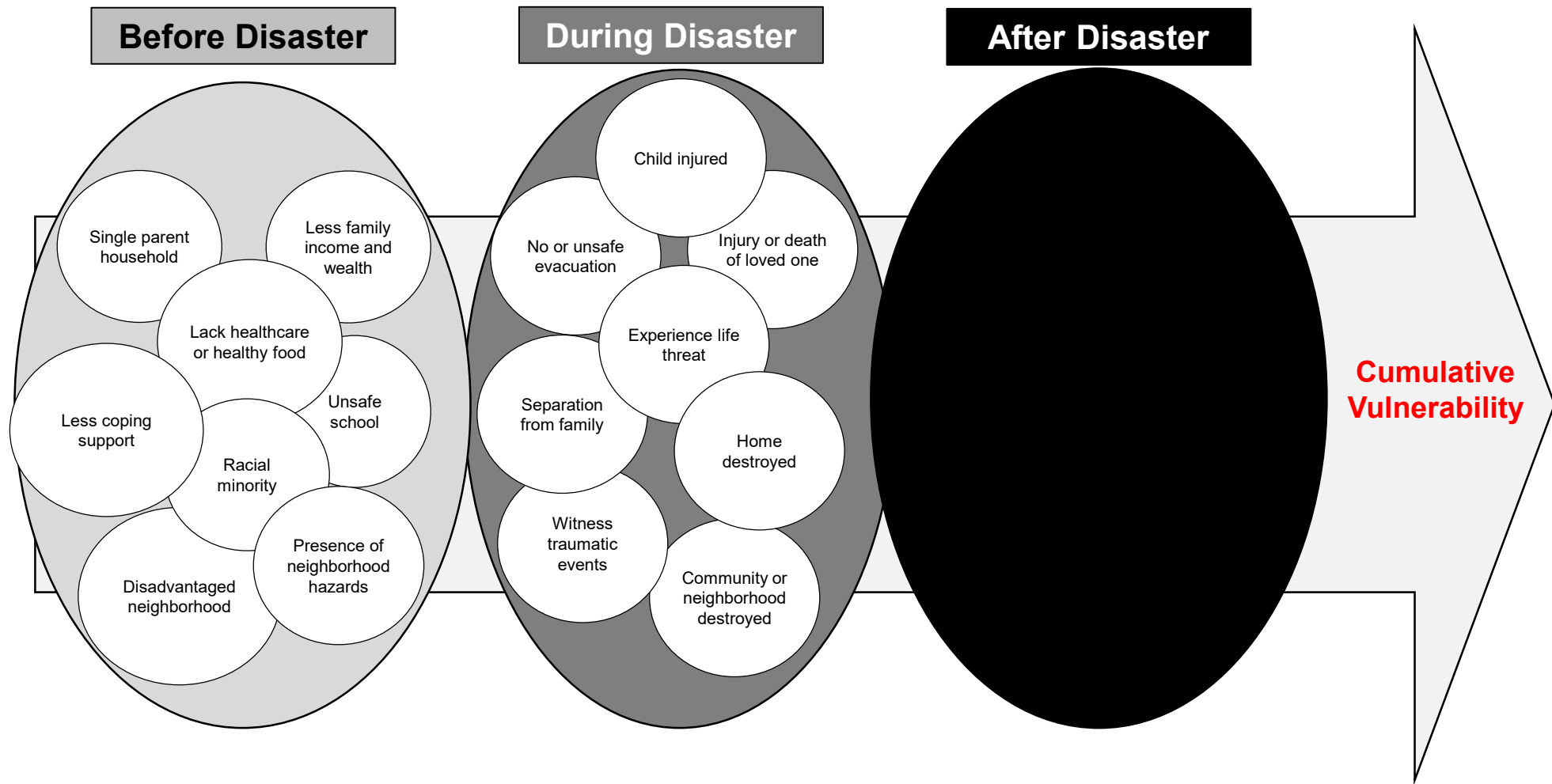


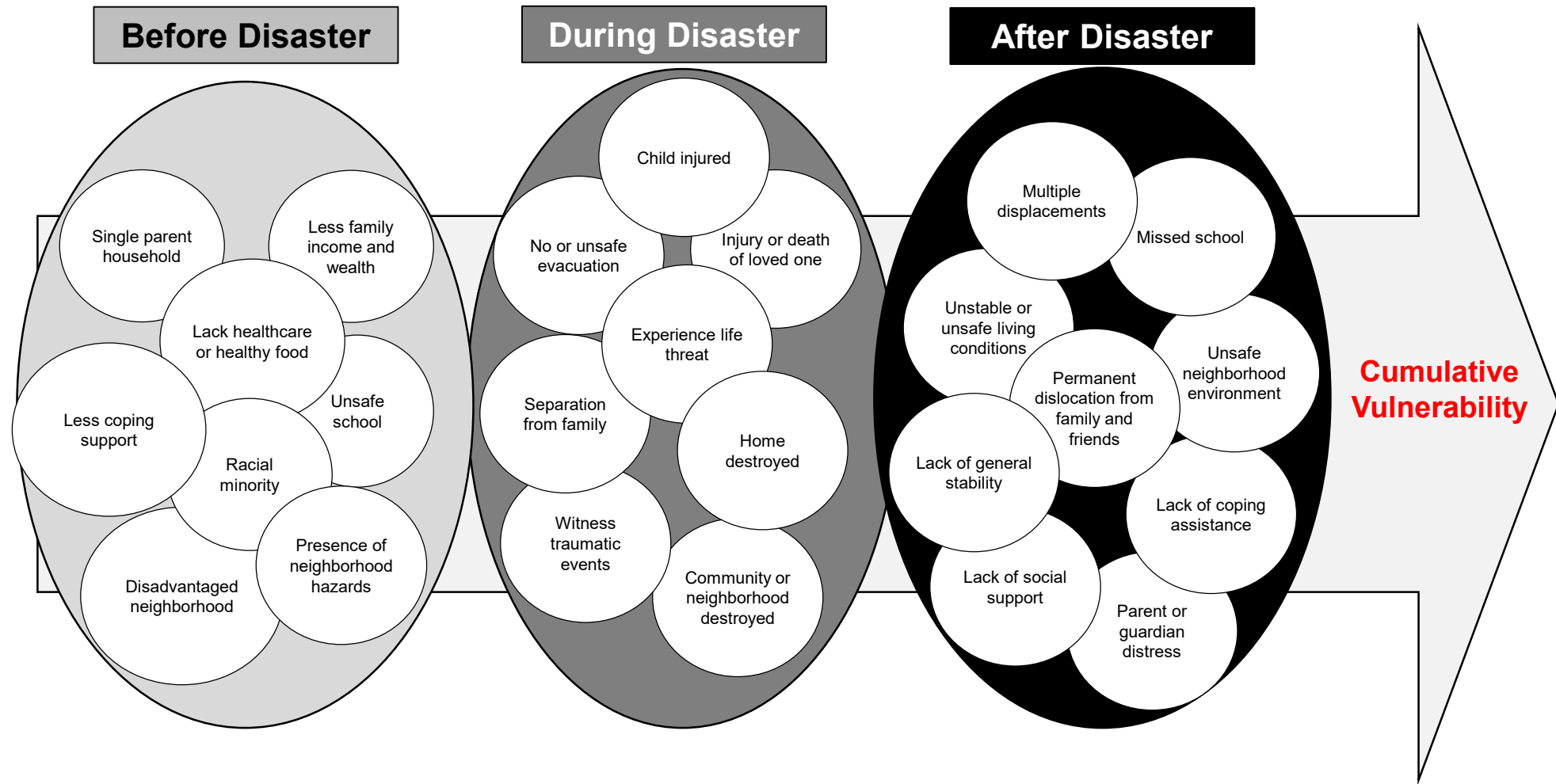
**August 29,
2005**













Los Angeles, California

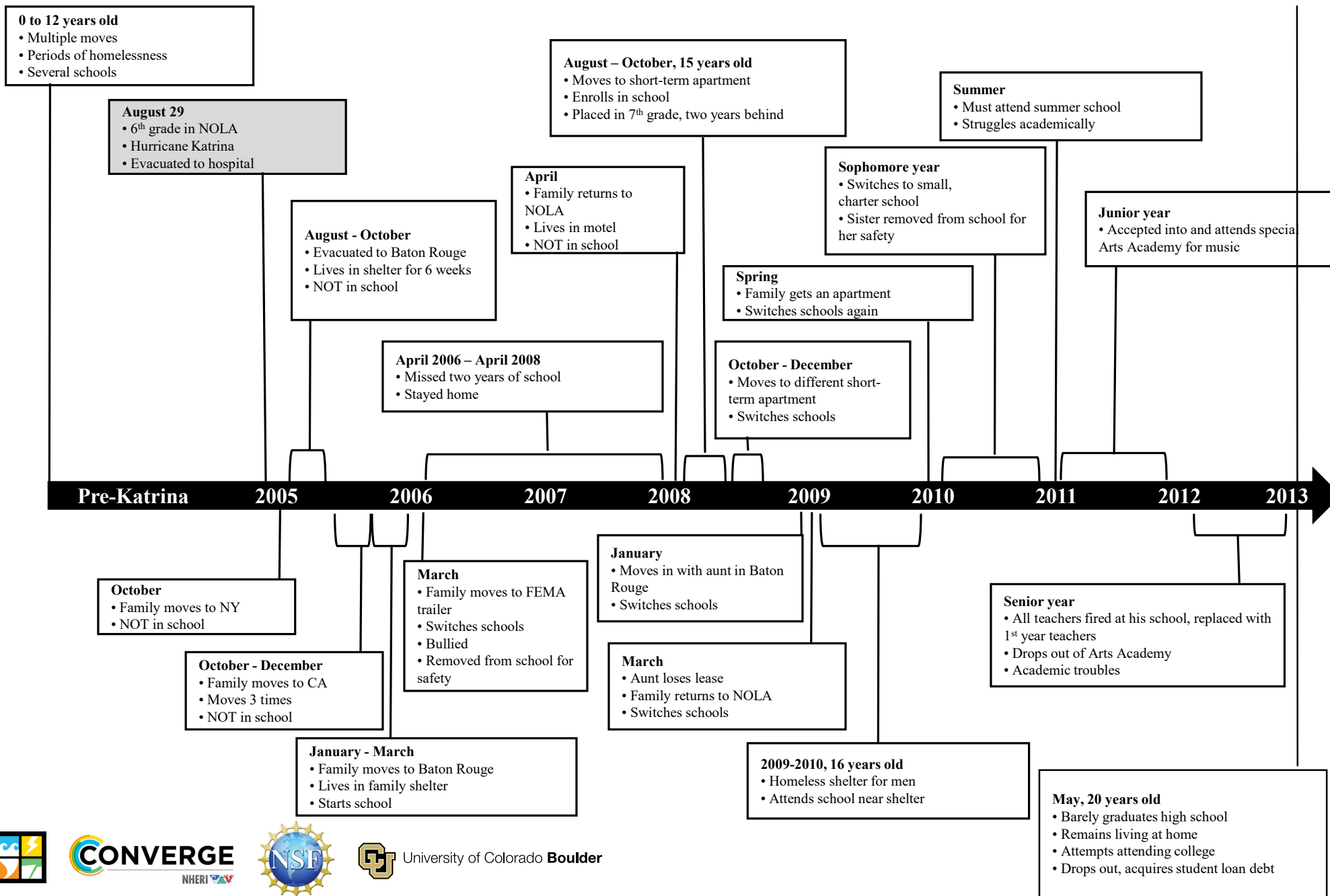
New York City, New York

New Orleans, Louisiana

Baton Rouge, Louisiana

Baton Rouge, Louisiana

New Orleans, Louisiana



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October
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in 7th grad

to

20

January
Moves in
Rouge
Switches

March
• Aunt lo
• Family
• Switch

***Experienced life threatening, traumatic evacuation**

***Moved 12 times in 7 years**

***Lost public housing assistance**

***Lost crucial sources of social and cultural support**

***Missed 2+ years of schooling**

***Dropped out of prestigious performing arts high school due to lack of academic preparation**







***Family was pushed deeper into the basement of poverty**

• Family moves to Baton Rouge
• Lives in family shelter
• Starts school

2009-2010, 16 years old
• Homeless shelter for men
• Attends school near shelter

May, 20 years old
• Barely graduates high school
• Remains living at home
• Attempts attending college
• Drops out, acquires student loan debt

How much does mitigation *actually* save?

| | | | | | | |
|--|--|----------------|------------|-------------------|-------------------|----------------|
|  National Institute of BUILDING SCIENCES™ | | ADOPT CODE | ABOVE CODE | BUILDING RETROFIT | LIFELINE RETROFIT | FEDERAL GRANTS |
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|  Earthquake | | 12:1 | 4:1 | 13:1 | 3:1 | 3:1 |
|  Wildland-Urban Interface Fire | | not applicable | 4:1 | 2:1 | not applicable | 3:1 |

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*Experienced life threatening. traumatic
evacu

*Move

*Lost

*Lost
suppo

*Miss

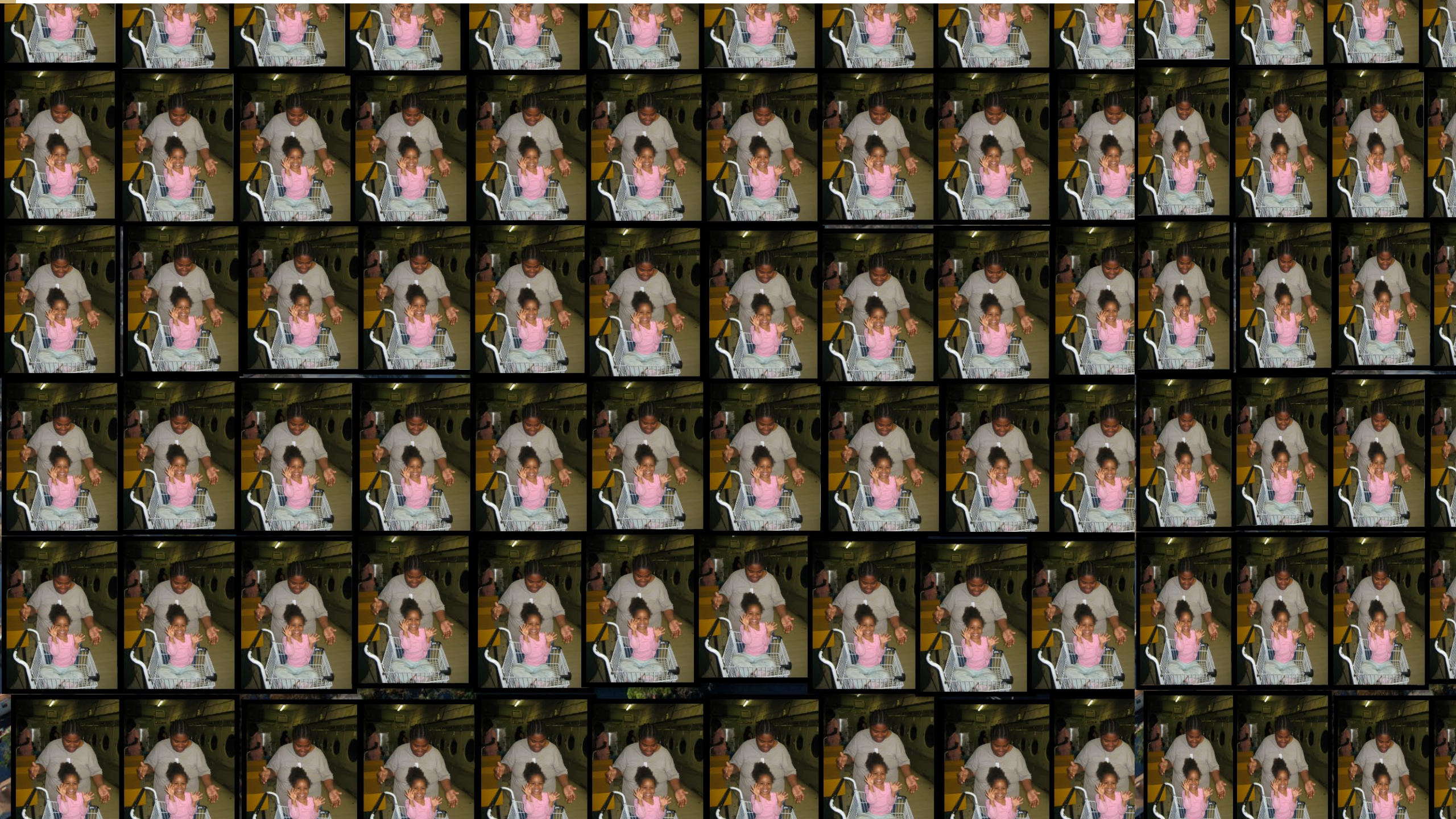
*Drop
high s
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*Fami
basement of poverty









Katrina Damaged or Destroyed:

***2.5 million homes**

***10,000 businesses**

***150 schools**



**5,000 children
separated from their
parents**

**The last child was
reunited with family in
April of 2006**



**372,000 school-aged
children were displaced**



**Two years after Katrina,
160,000 children
remained dislocated**



Five years after,
exposed children were
five times as likely as
comparable non-
exposed children to be
suffering from Serious
Emotional Disturbance





**How much does mitigation
actually save?**

**How can we best articulate the economic
and social value of mitigation?**

How much does mitigation *actually* save?

1. To answer this question, we need to know more

Sutley, van de Lindt, and Peek, 2016a, 2016b, 2017



University of Colorado **Boulder**

How much does mitigation *actually* save?

1. To answer this question, we need to know more

Buildings and
Building Codes



Land Use Planning

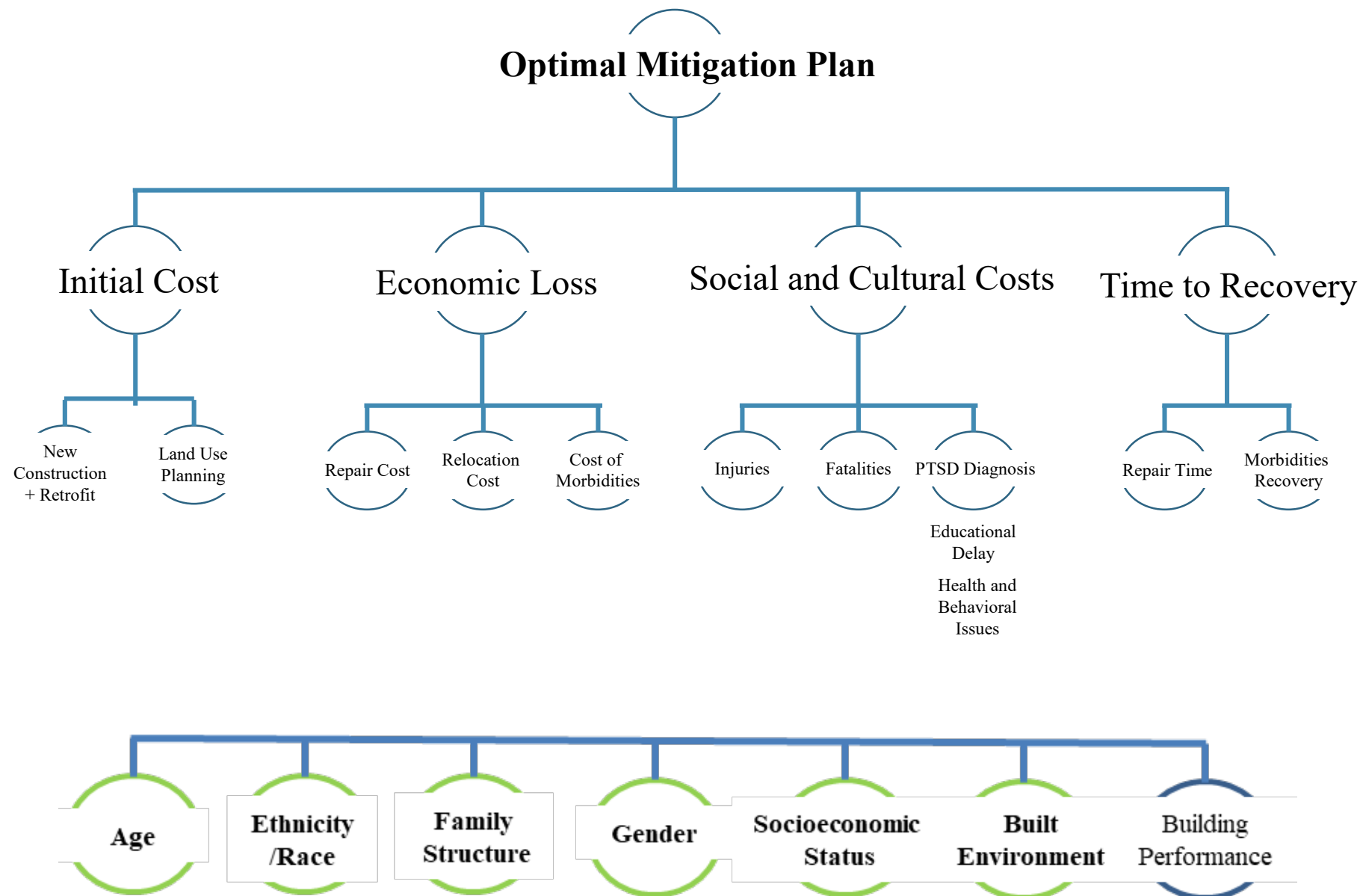


People



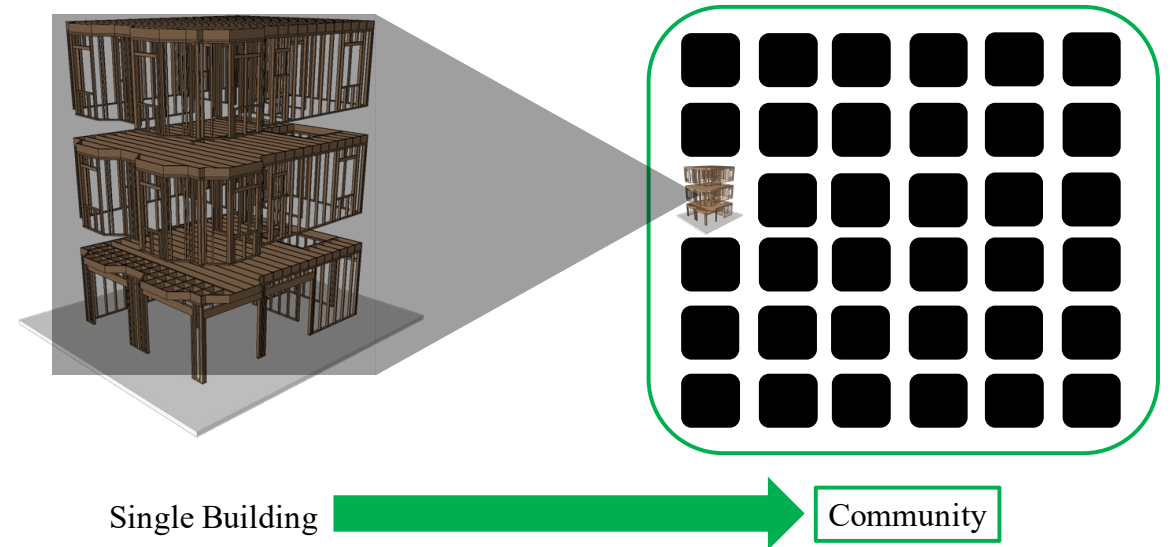
How much does mitigation *actually* save?

1. To answer this question, we need to know more about buildings, land use planning, and people
2. When we do not consider social context and social vulnerability, we may dramatically underestimate the *economic and social* value of mitigation



What is the economic *and* social value of mitigation?

- 1 Hazard – Earthquake
- 1 Building Type – Soft Story Wood Frame Construction
- 1 Strategy – Retrofit
- 1 Place – Los Angeles (3 socioeconomically diverse communities)
- Multiple social demographic considerations



Sutley, van de Lindt, and Peek, 2016a, 2016b, 2017

What is the economic *and* social value of mitigation?

Initial Cost:

$$RO_1 = \sum_{i=1}^{n_{arch,ret}} cost_{ret,i} \cdot fa_i \cdot (n_{gen,i} - n_{gen_0,i})$$

Economic Loss:

$$RO_2 = EL_{RC} + EL_{RL} + EL_M$$

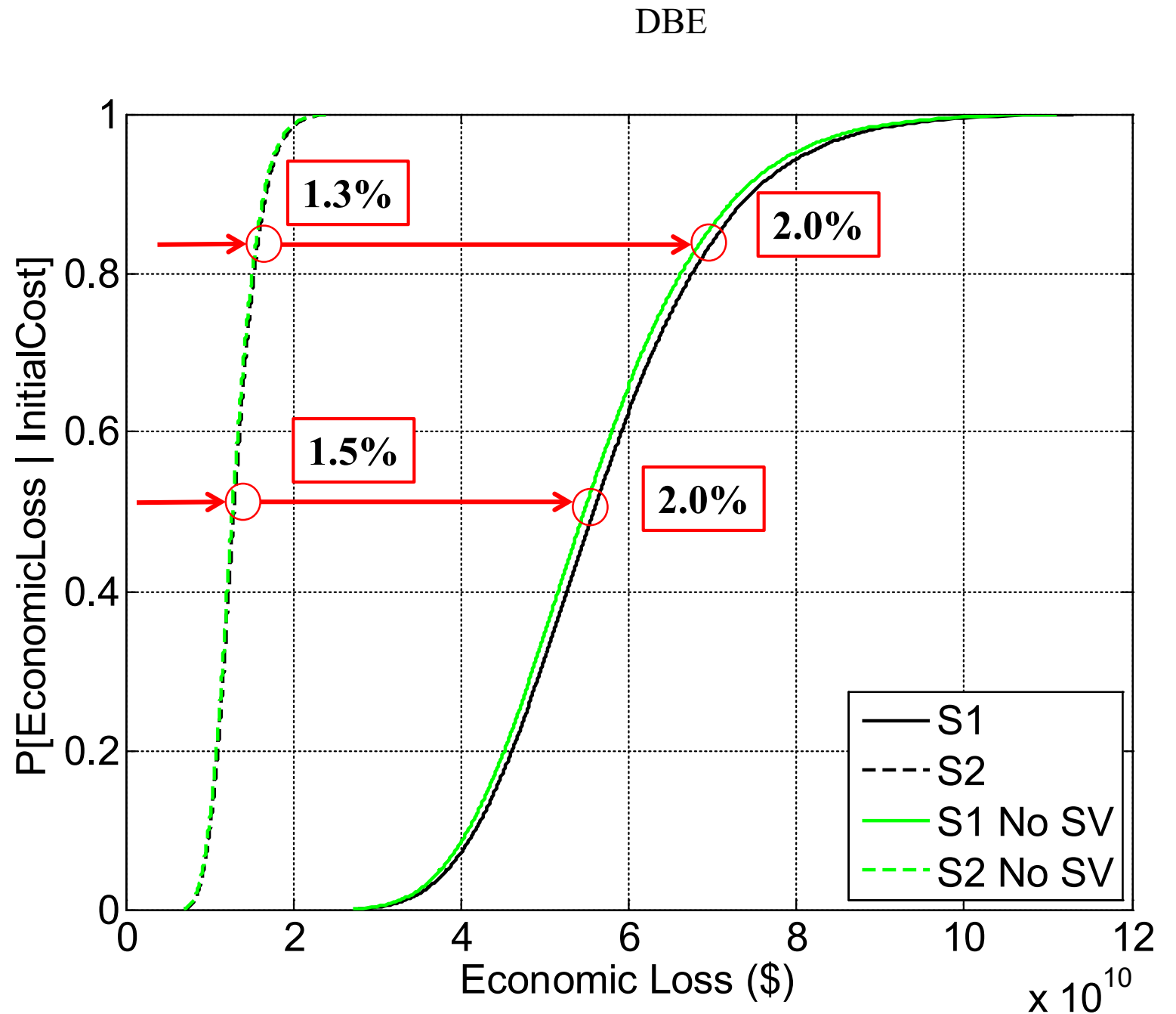
Number of Morbidities:

$$RO_3 = \sum_{ds=1}^{n_{ds}} \left[\left(\sum_{is=1}^{n_{is}} MR_{is,ds} + MR_{pr,ds} \right) \cdot \sum_{i=1}^{n_{arch}} (n_{i,ds} \cdot occ_i) \right]$$

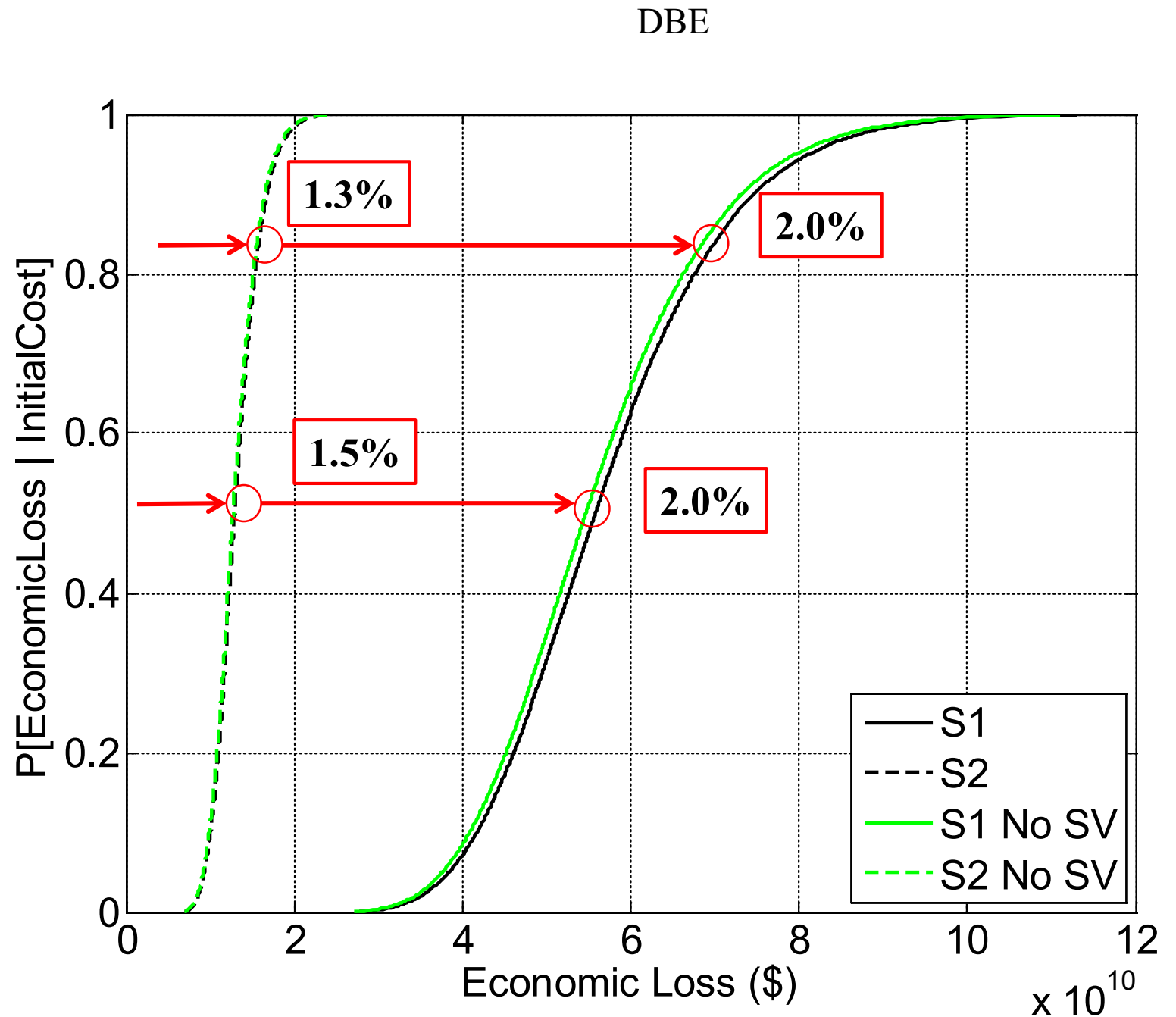
Time to Recovery:

$$RO_4 = \max \begin{cases} RecT_{Morbidity} \\ RecT_{Repair} \end{cases}$$

Economic Loss

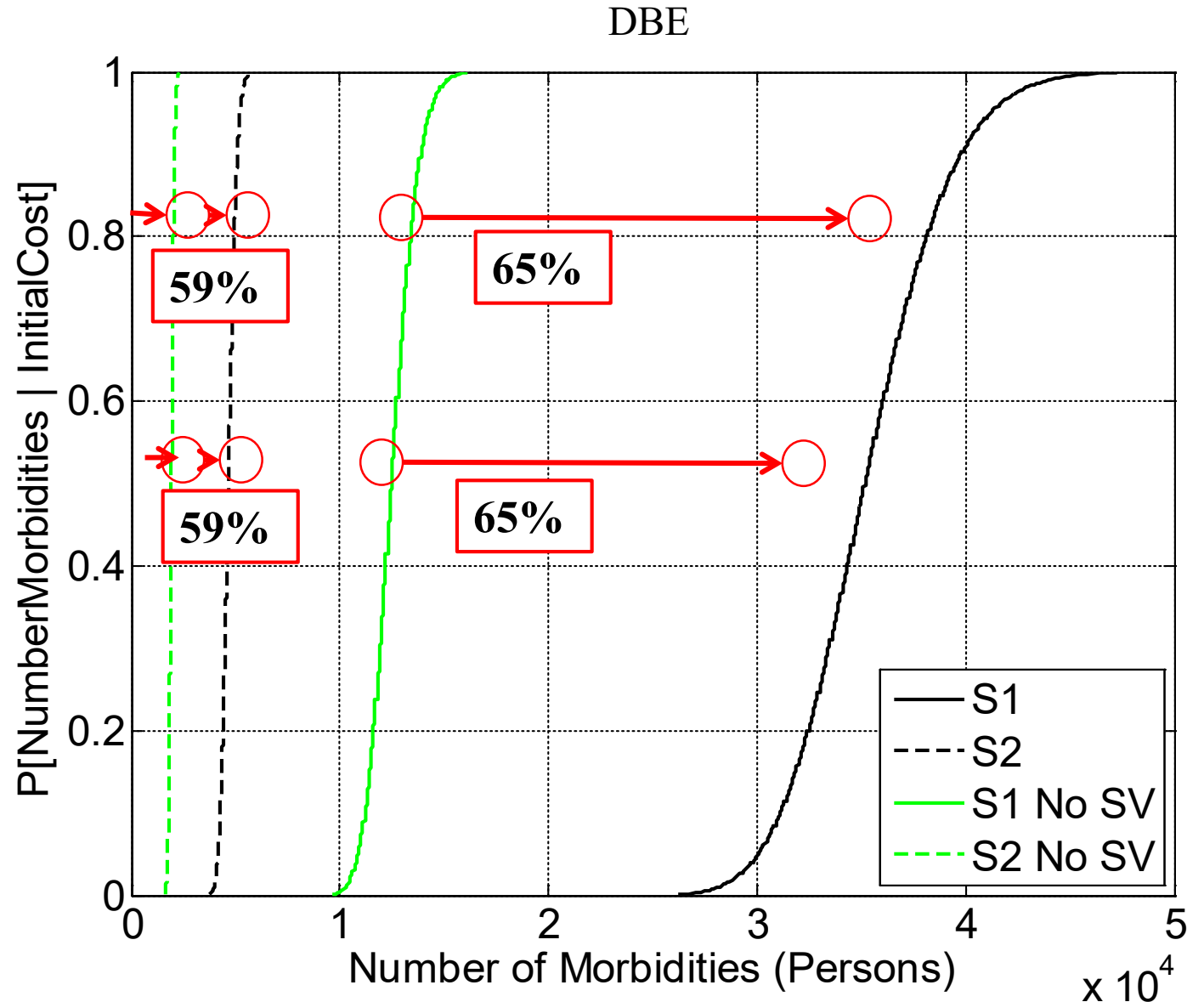


These percent differences equate to:
\$1.1B and **\$200M** –
 Over **\$43B** could be saved in total

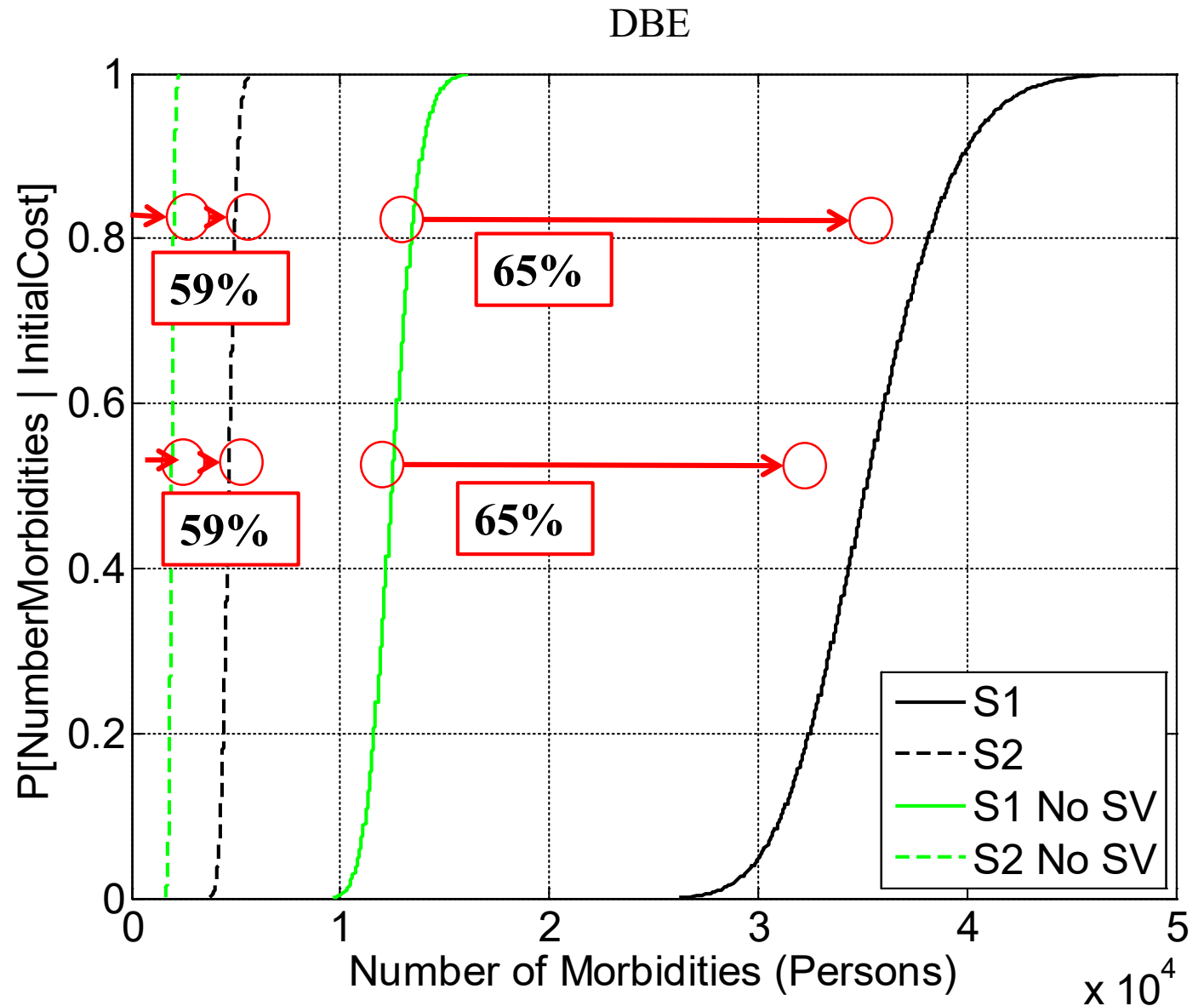


Mitigation is about Reducing Economic Loss *and* Improving Societal Outcomes

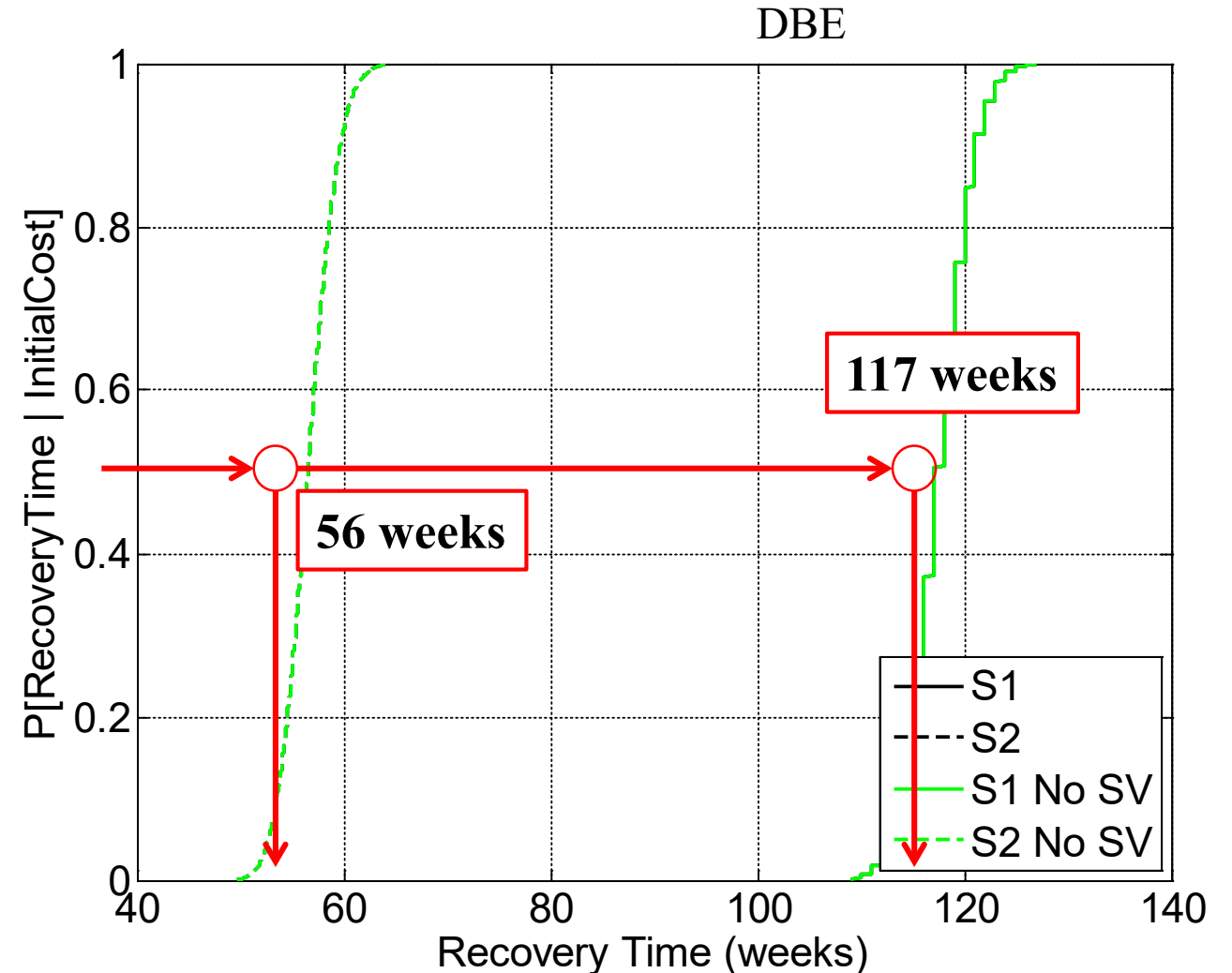
Deaths, Injuries, and PTSD



Over **30,000 people** –
including the most
vulnerable – could be
saved from injury, fatality,
or PTSD



Retrofitting
reduces recovery
time by **52%**
(61 weeks).



In the end...

- Mitigation involves deeply human stories – **we need to tell them more often.**
- We need to move beyond dollars to what makes sense to people. Current best estimates of what mitigation saves *underestimate* the social, cultural, and moral value of mitigation.
- Those underestimates are even greater when we don't consider *population diversity, social vulnerability, and social equity goals of mitigation.*
- In a time of radical inequality, we need to clarify our values, priorities, and actions.
- Mitigation is not only about what is replaceable. **It is about what is irreplaceable.**





University of Colorado **Boulder**

THANK YOU

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Director, Natural Hazards Center and CONVERGE

University of Colorado Boulder

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