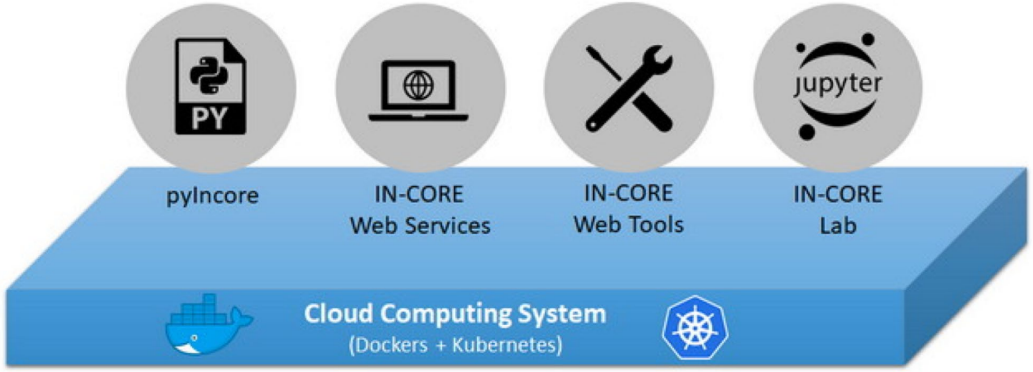
IN-CORE User Workshop at Lifelines

John W. van de Lindt

Co-Director, Center for Risk-Based Community Resilience Planning



NIST-CoE Community Resilience Overview

- Improve the performance of built environment for natural hazards at the community scale
- Characterize interdependencies between social, economic, and physical systems
- Develop science-based tools that communities can use to assess/improve their resilience

First 5 years (2015-2020)

- ***Open-source inter-disciplinary computational environment (IN-CORE)*** to assess community resilience and support policies and decisions to advance community resilience goals.

Knowledge Creation

- ***Comprehensive set of testbeds and hindcasts*** to validate IN-CORE.

Second 5 years (2020-2025)

- ***Measurement and decision science through IN-CORE***, including interdependencies, uncertainty, intermodal systems, and risk-informed decision support.

Knowledge Implementation

- ***Decision support and implementation*** of resilience science through ***technology transfer***.

NIST CoE Executive Team

John van de Lindt
Co-Director

Jamie Kruse
Co-Director

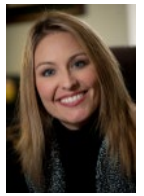
Jong Lee
Task 1: Development of IN-CORE Platform
University of Illinois at Urbana Champaign

Dan Cox
Task 1: Development of IN-CORE Platform
Oregon State University

Shannon Van Zandt
Task 2: IN-CORE Outreach and Sustainability
Texas A & M University

Harvey Cutler
Task 3: Mitigation and Recovery
Colorado State University

Andre Barbosa
Task 4: Verification and Validation (V&V) of IN-CORE
Oregon State University



Jamie Padgett
Task 5: Modeling of Complex Systems
Rice University

Paolo Gardoni
Task 6: Modeling of Interdependencies and Propagation of Uncertainty
University of Illinois at Urbana Champaign

NIST CoE Faculty, Developers, & Staff



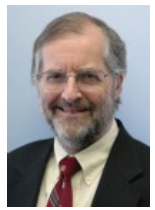
CAL POLY POMONA




Portland State UNIVERSITY




ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

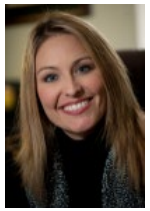





Oregon State UNIVERSITY OSU

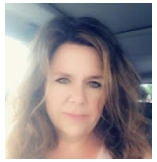
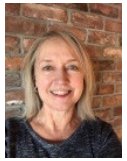



COLORADO STATE UNIVERSITY



RICE


KU THE UNIVERSITY OF KANSAS



Stony Brook University



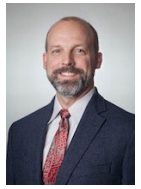
The UNIVERSITY of OKLAHOMA



Georgia Tech


East Carolina UNIVERSITY






TEXAS A&M UNIVERSITY


USNA UNITED STATES NAVAL ACADEMY

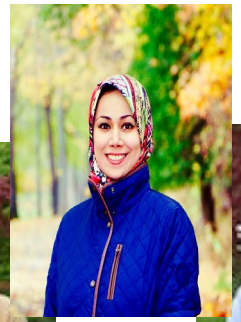
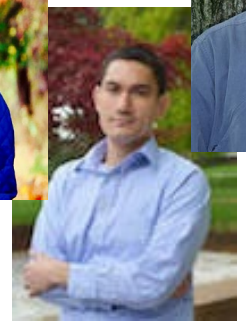
NIST Collaboration Team




Applied Economics

Community Resilience







Earthquake


Disaster Failure Studies



Materials and Structural Systems

Structures

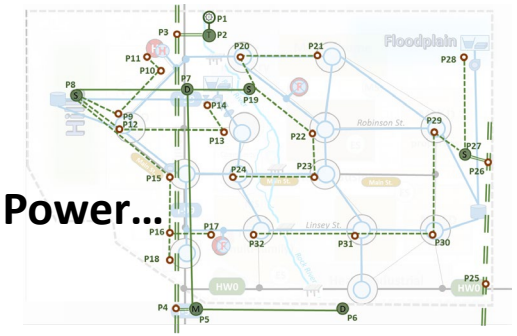


No pictured:
Christopher Segura

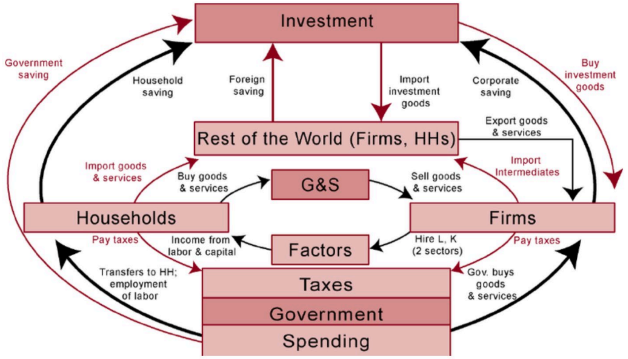
Begin by developing an integrated community model

Buildings…

Power…

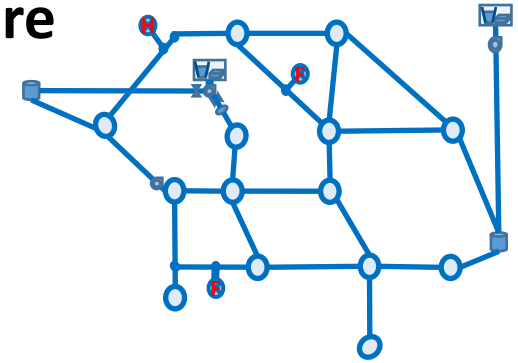


Economy

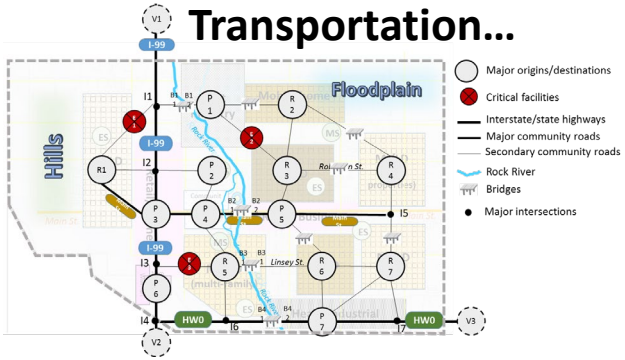


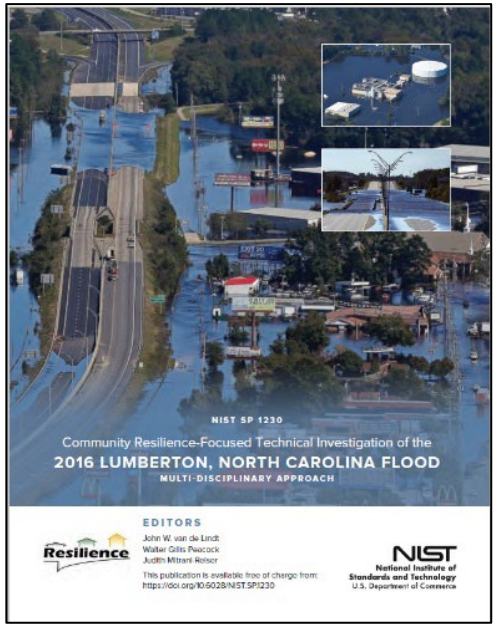
Physical infrastructure

Water…



Transportation…

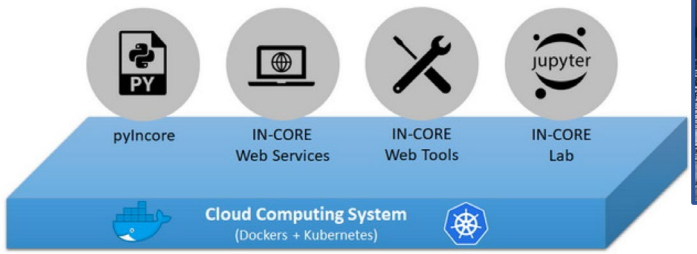




Social (e.g . households, institutions)

IN-CORE Interdependent Networked- Community Resilience Modeling Environment

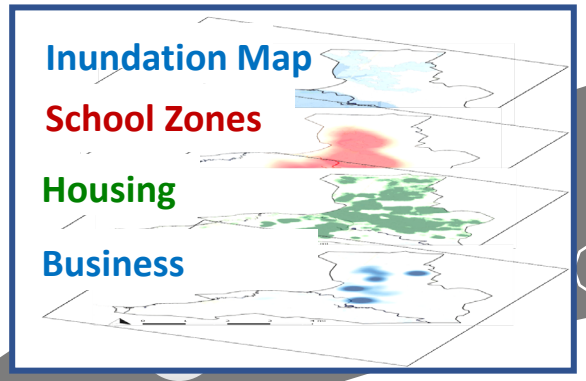
- Physical infrastructure
- Economic health
- Social services
- Information science



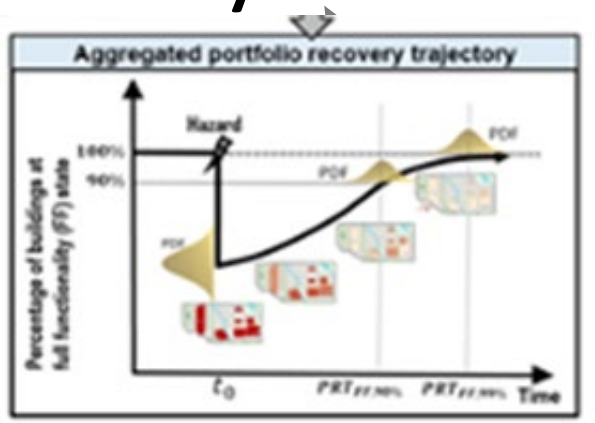
https://incore.ncsa.illinois.edu

https://github.com/IN-CORE/

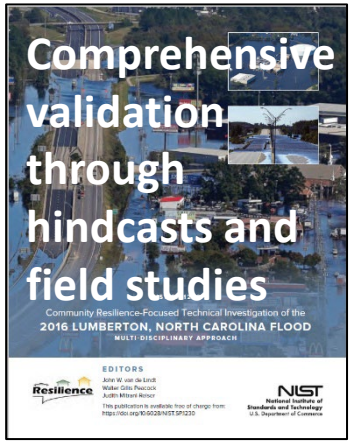
1 Damage and loss; impacts of natural hazards on communities



2 Interdisciplinary recovery with fully integrated supporting databases

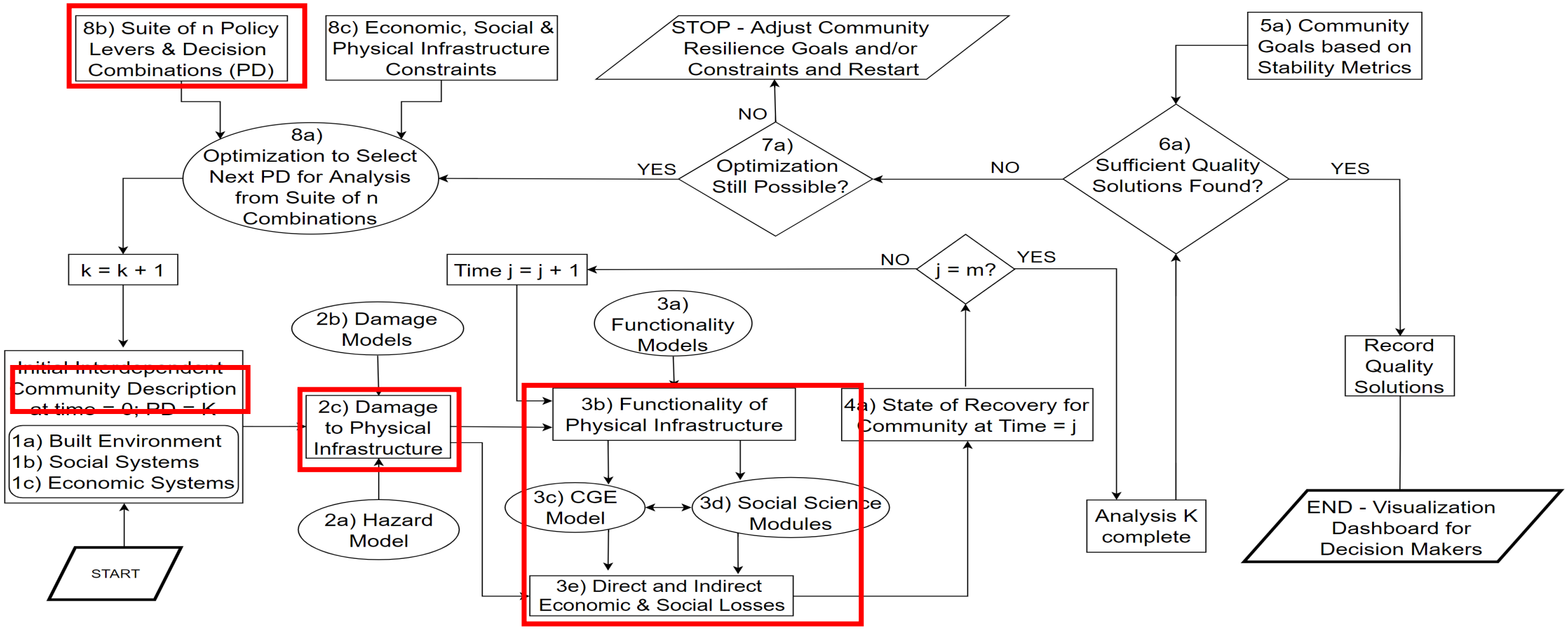


3 Alternative actions to enhance community resilience & inform planning

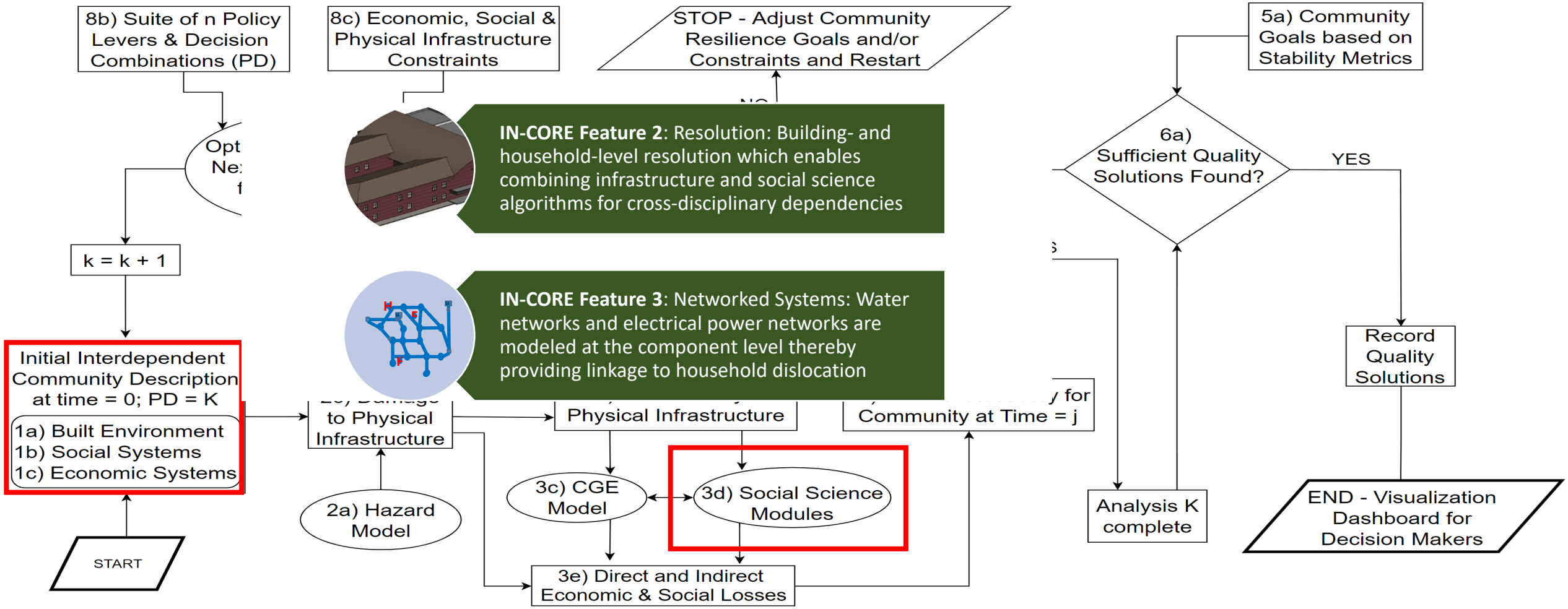


NIST Financial Assistance Awards Number: 70NANB15H044 & 70NANB20H008

Modeling community resilience



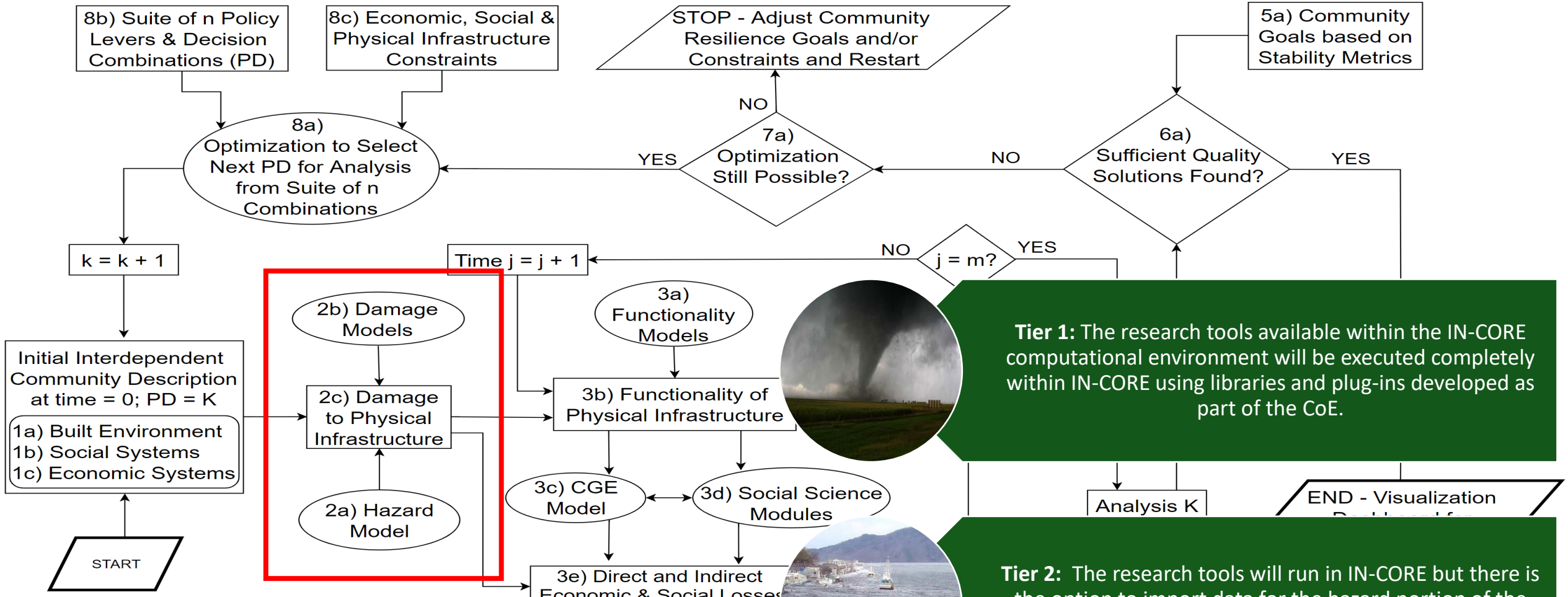
Modeling community resilience



IN-CORE Feature 2: Resolution: Building- and household-level resolution which enables combining infrastructure and social science algorithms for cross-disciplinary dependencies

IN-CORE Feature 3: Networked Systems: Water networks and electrical power networks are modeled at the component level thereby providing linkage to household dislocation

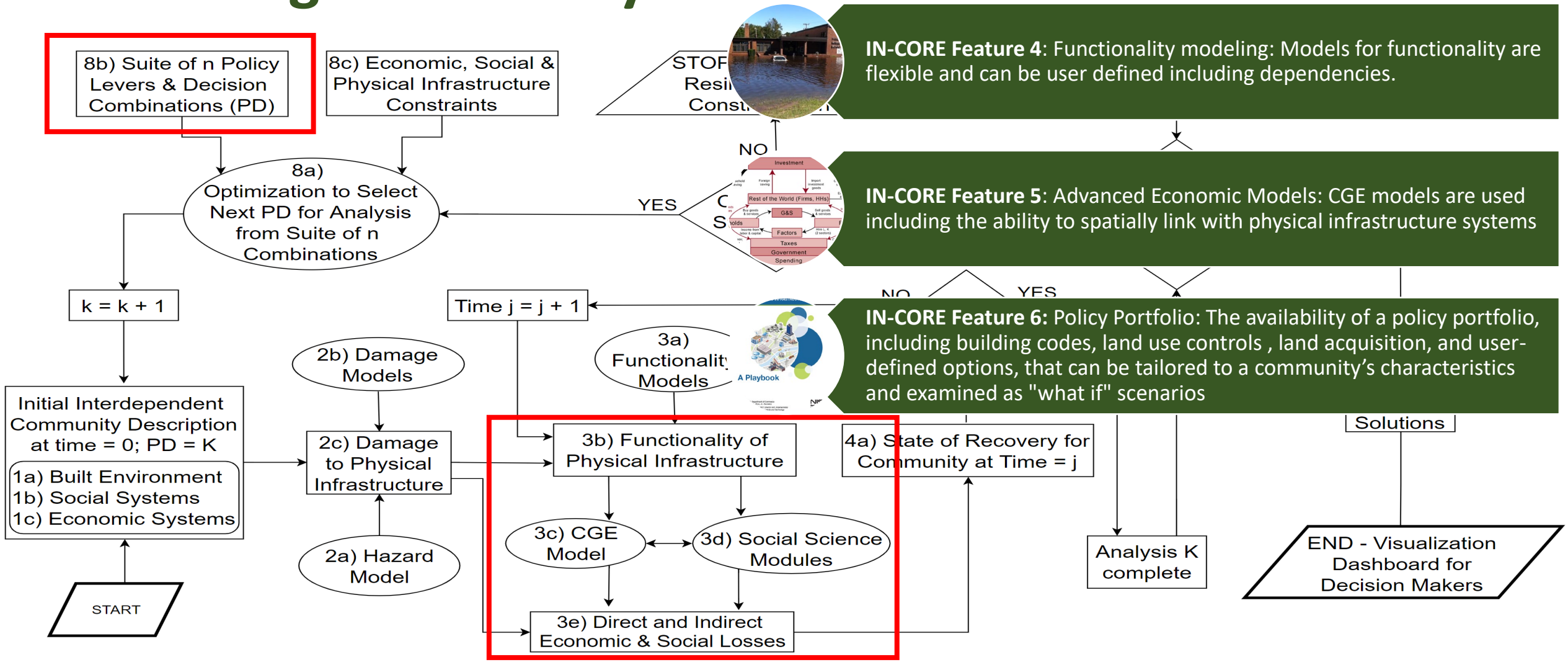
Modeling community resilience



Tier 1: The research tools available within the IN-CORE computational environment will be executed completely within IN-CORE using libraries and plug-ins developed as part of the CoE.

Tier 2: The research tools will run in IN-CORE but there is the option to import data for the hazard portion of the analysis, e.g. a wind field shape file from an outside software (or other) source, overland surge flow from ADCIRC, etc.

Modeling community resilience

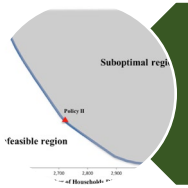


IN-CORE Feature 4: Functionality modeling: Models for functionality are flexible and can be user defined including dependencies.

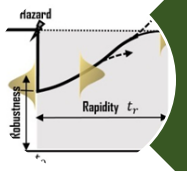
IN-CORE Feature 5: Advanced Economic Models: CGE models are used including the ability to spatially link with physical infrastructure systems

IN-CORE Feature 6: Policy Portfolio: The availability of a policy portfolio, including building codes, land use controls , land acquisition, and user-defined options, that can be tailored to a community's characteristics and examined as "what if" scenarios

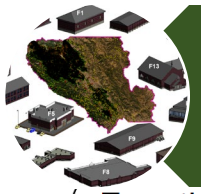
Modeling co



IN-CORE Feature 7: Optimization and Decision Support: Decision support on allocation of limited resources (budget, labor, etc.) towards mitigation and recovery efforts to meet one or more objectives subject to community-defined constraints



IN-CORE Feature 8: Robust Temporal and Spatial Analysis: IN-CORE enables users the ability to timestep rather than using trajectories. This is necessary to consider the effects of policy options at key points in time during a recovery simulation



IN-CORE Feature 9: Suites of fragilities available including tornado wind and flood fragilities

Modeling community resilience: components

- Measurement science is implemented on a platform called Interdependent Networked Community Resilience Modeling Environment (IN-CORE)

- It incorporates a risk-informed approach to decision-making that enables quantitative comparisons of alternative resilience strategies.

- On the platform, users can run scientific analyses that model the impact of natural hazards and study their impact on communities to improve resilience.

The Center for Risk-Based Community Resilience Planning is a NIST-funded Center of Excellence; the Center is funded through a cooperative agreement between the U.S. National Institute of Standards and Technology and Colorado State University (NIST Financial Assistance Award Numbers: 70NANB15H044 & 70NANB20H008). The views expressed are those of the presenters, and may not represent the official position of the National Institute of Standards and Technology or the US Department of Commerce.

Numerous researchers with the Center of Excellence contributed to the contents of these presentations and a sincere thank you is due to everyone affiliated with the Center for Risk-Based Community Resilience Planning.

Enjoy the workshop!

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