

# *Climate-Cybersecurity-Resilient Infrastructure: Relevant R&D underway at NSF*

Anjuli S. Bamzai, Ph.D.

Senior Science Advisor, Global Climate Change

Directorate for Geosciences, U.S. National Science Foundation

*Workshop:*

*Unravelling the Cyber- Physical-Social Infrastructure Climate Change Nexus*

*July 29 - August 1, 2024, Washington D.C.*



# NSF: Where Discoveries Begin



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*“To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes”*





# Coupled Social & Cyber Physical Systems (CPS)

## Research, Infrastructure, Applications and Services

- Food
- Water
- Agriculture
- Health
- Financial services
- Financing of next-gen investments
- Supply chains
- International trade, negotiations



R&D efforts across CISE, ENG, GEO, OISE, SBE and other NSF Directorates and Offices.



# Cyber Physical Systems (CPS)

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# Climate Change



- Network, Applications
- Identity Management
- Mobile Security
- Information, Data , Cloud
- Future of work
- Operational Security
- Disaster Recovery
- Business Continuity Planning

- Direct impacts on CPS  
heatwaves, wildfire, flooding
- Compound CPS threats and  
vulnerability to cyber attacks

Robust & Resilient  
Cyber Physical  
Systems







## GLOBAL CENTERS:

Use-Inspired Research  
Addressing Global Challenges in  
Climate Change and Clean Energy

Image Credit: Kimberly Pham



UK Research  
and Innovation



Australia's National  
Science Agency

Canada



# US-Canada Center on Climate-Resilient Western Interconnected Grid

**Goal of Global Center:** to assess the risk of extreme event  
for power grids using state-of-the-art modeling tools

# Infrastructure Dynamics and Adaptive Recovery from Repeated Shocks through Resilience Stress Testing in Complex Human/Natural Systems: Testing in Ukraine

## Partners: USA – Ukraine – Poland – Estonia – Lithuania



Resilience Stress-Testing and Recovery      Case studies from five different focal points      A Global Team on Quantitative Resilience Analytics      Rapid guidance on recovery pathways      Improved preparedness for future shocks



Team building and Co-Creation Activities      Open Access Quantitative Resilience Analytics Training Modules      Talks and posters in IEEE, IES, SRA      UF Biocomplexity Seminar Activities      Outreach activities involving academics, young professionals, government officials in partner institutes

International Mobility and Exchange of Data Scientists      Educational outreach in Ukrainian Institutes      Multi-lingual outputs



# Examples of ongoing projects



## CISE: NSF-JST: Enabling Human-Centered Digital Twins for Community Resilience

- Disaster Digital Twin framework that integrates diverse data sources to improve community resilience for disaster response strategies to support vulnerable populations

## ENG: Operational and economy-wide impacts of compound cyber-attacks and extreme weather events on electric power networks

- Compound cyber–physical threat can exacerbate regional electricity disruptions by 3 times
- A compound cyber–physical threat can exacerbate economy-wide losses by 10 times



## TIP: SBIR Phase I: CAS: Digital Twin for Climate Resilience Analytics

- Create and design state-of-the-art digital twin technology that harnesses power of big data and machine intelligence
- Enable proactive and predictive lens on community preparedness, evacuation measures, protective actions, and post-emergency event recovery

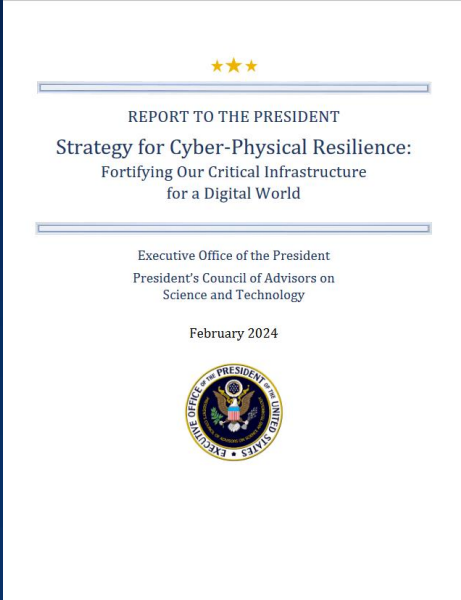


## EPSCOR: Funding of \$ 77.8 M to build climate resilience capacity



# Strategy for Cyber Physical Resilience: Fortifying our Critical Infrastructure for a Digital World

## PCAST, 2024



- **CPSR** – the capacity of an integrated system to keep running – even if not at peak performance – should it lose specific functions. Challenges include degradation or cessation of one or more aspects of the computational or physical functions due to component failures, human errors, natural disasters, or malicious attacks.
- **RECOMMENDATION** - Formulate a National Plan for Cyber-Physical Resilience Research. Partner across federal agencies to define priorities and support research in those areas.

**Goal:** to create focused research across programs that increase the likelihood of successful research results, but more importantly help ensure that such results will transition into actual use.

## FTAC Organization

- **Co-Chairs**
  - David Alexander, DHS
  - David Corman, NSF
  - Kristin Ludwig, OSTP
  - Martin Stanley, NIST
- **26 Participating Federal Agencies**
- **Meet on a monthly basis**
- **Report on R&D Needs Late June 2025**



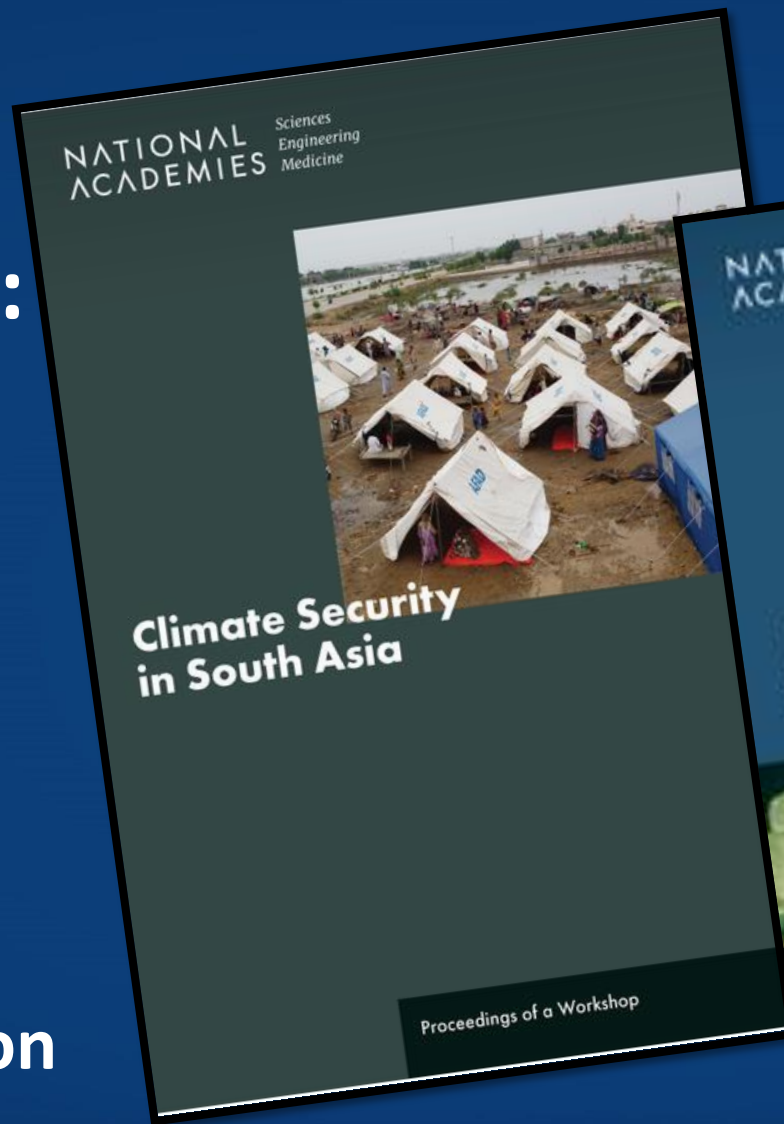




# National Academy Climate Security Roundtable

## Roundtable Expertise:

- Food, Water, Energy
- Health
- Urban
- Earth Systems
- Conflict, Governance
- Development, Adaptation
- Computing
- Risk



## Forthcoming

- Urban Systems
- Food & Agriculture



