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ENGINEERING RESEARCH CENTER

Community Pyro-Resilience, Equitability, and Sustainability

Mission

To achieve wildfire ***resilience*** in an ***equitable*** and ***sustainable*** manner with the help of convergence research and co-production with stakeholders

WHAT WE CURRENTLY HAVE

- National low spatio-temporal resolution fire detection and ecosystem response datasets
- Forestry- and rangeland-centric workforce to handle wildfires with limited access to advanced wildfire Decision Support tools.
- Isolated centers and labs focused on pieces of the wildland fire problem.

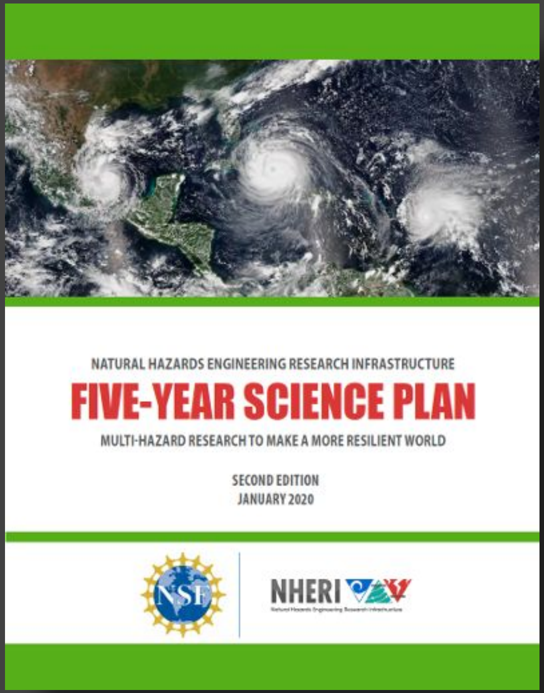
Call to Action

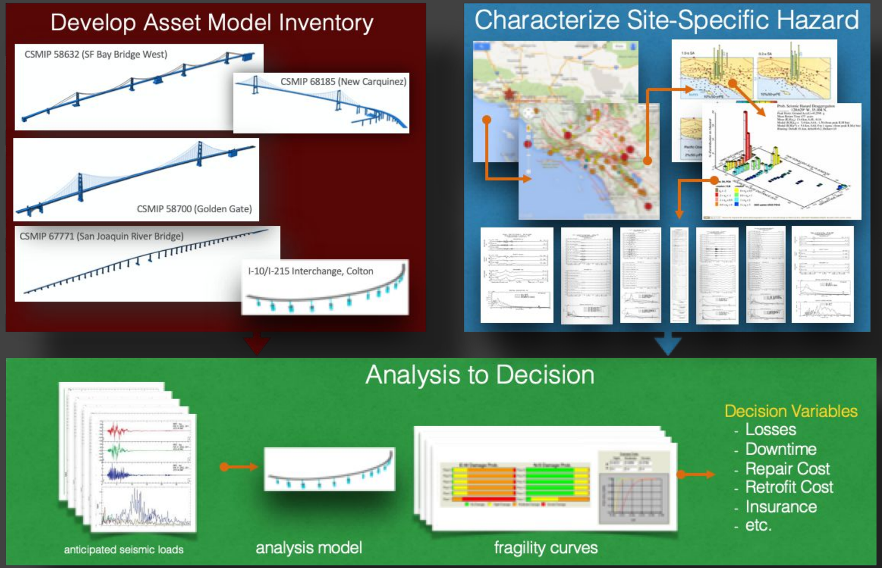
WHAT IS URGENTLY NEEDED

- Technology, predictive tools, and design codes to help communities prepare for and survive fires.
- System to integrate existing wildfire tools and data nationally.
- System to share data and promote standards.
- Workforce trained in diverse perspectives including engineering, fires science, and community engagement.

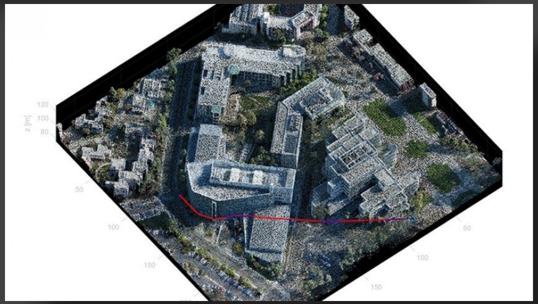
Why a Center?

- Siloed approaches will not yield a solution to a "wicked problem"
- A system-of-systems perspective is lacking
- Convergent research towards a unified vision is needed



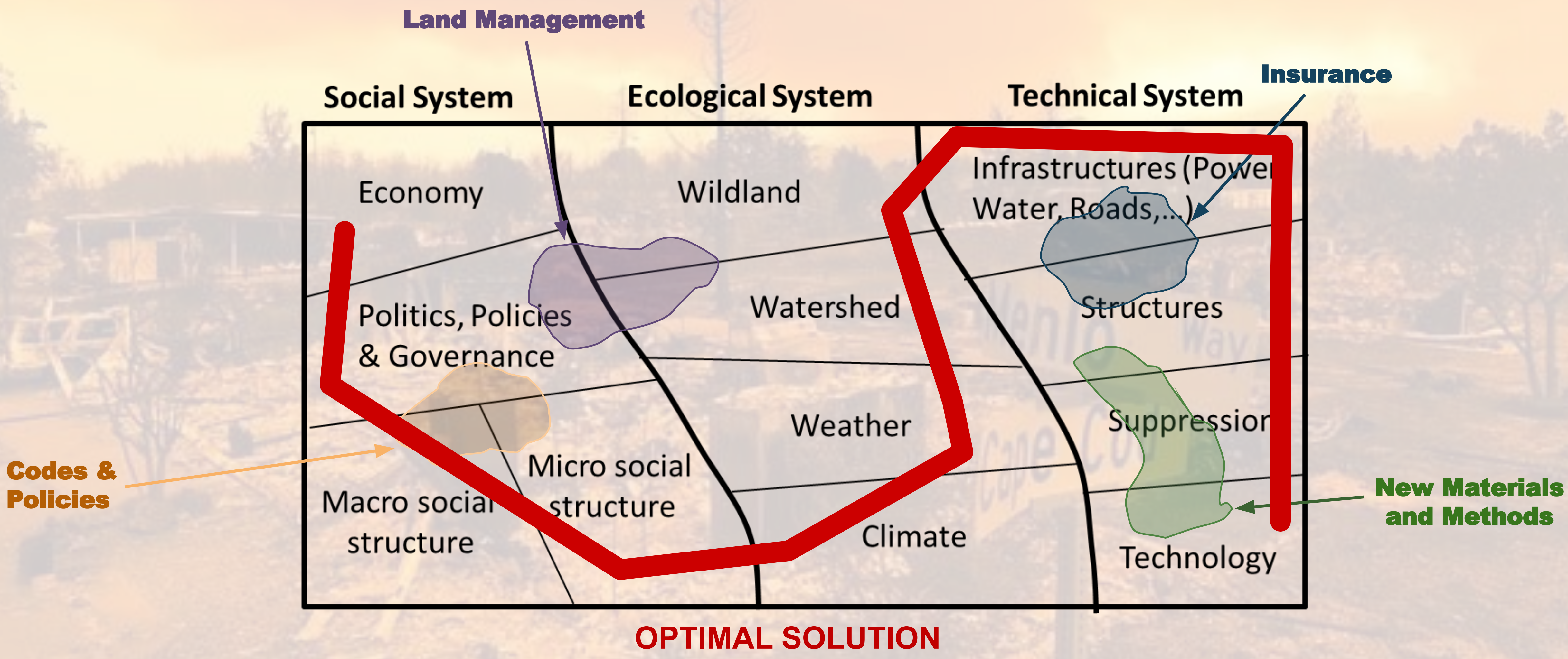


Risk Science, Computer Vision, AI, Sensors, Augmented Reality, Data Analytics



Why an Engineering Center?

- Building on decades of experience in hazard engineering and disaster resilience sciences
- Converging fundamental science and technology solutions towards decision support tools to tackle the wildfire problem



A "Wicked" Problem

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How are we different?

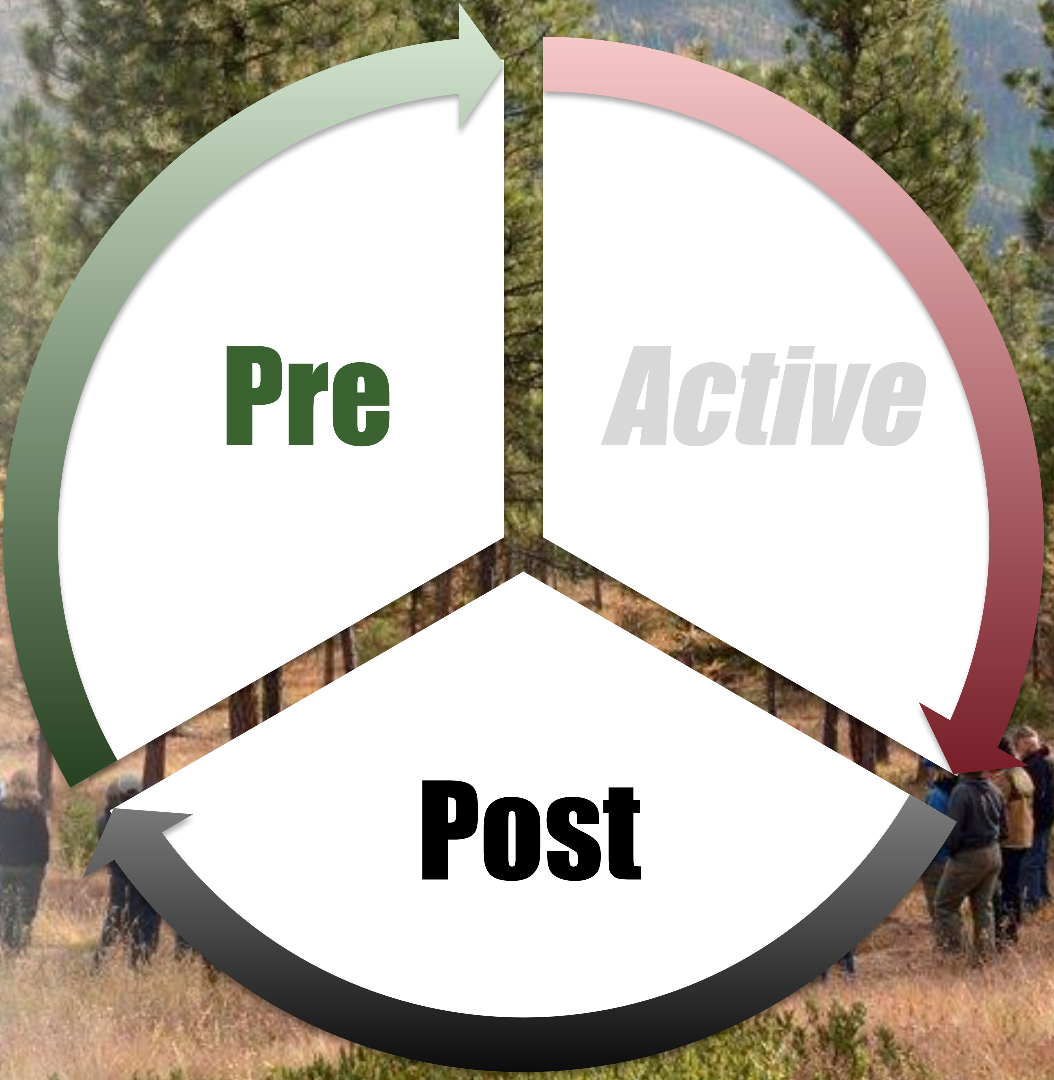
Open Source

Convergence and Co-Production by Academia, Government, Private Enterprise, and Nonprofits

Emphasizing resilience-impacting regimes of wildfire (Pre and Post)

Characterizing socio-economic risks & resilience

Featuring *Makers* & *Field Operations* teams



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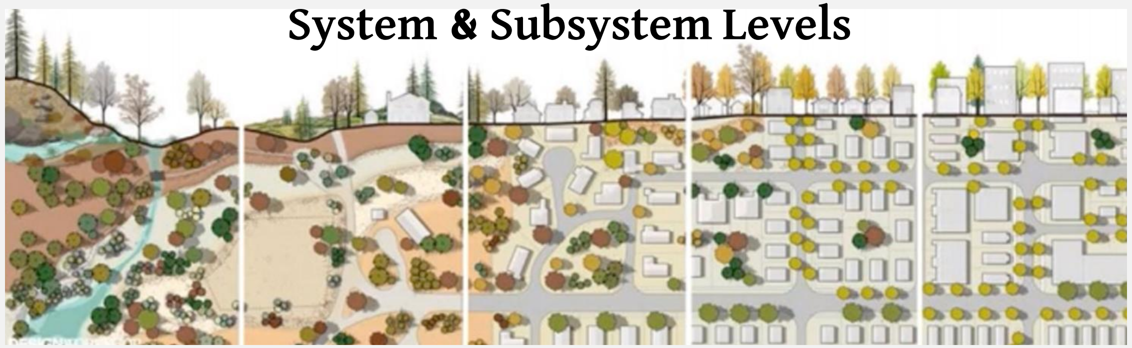
Building Resilience from the Ground Up

Sustainable & Equitable Resilience Pathways

Resilience Assessment Framework

Loss Risk Assessment

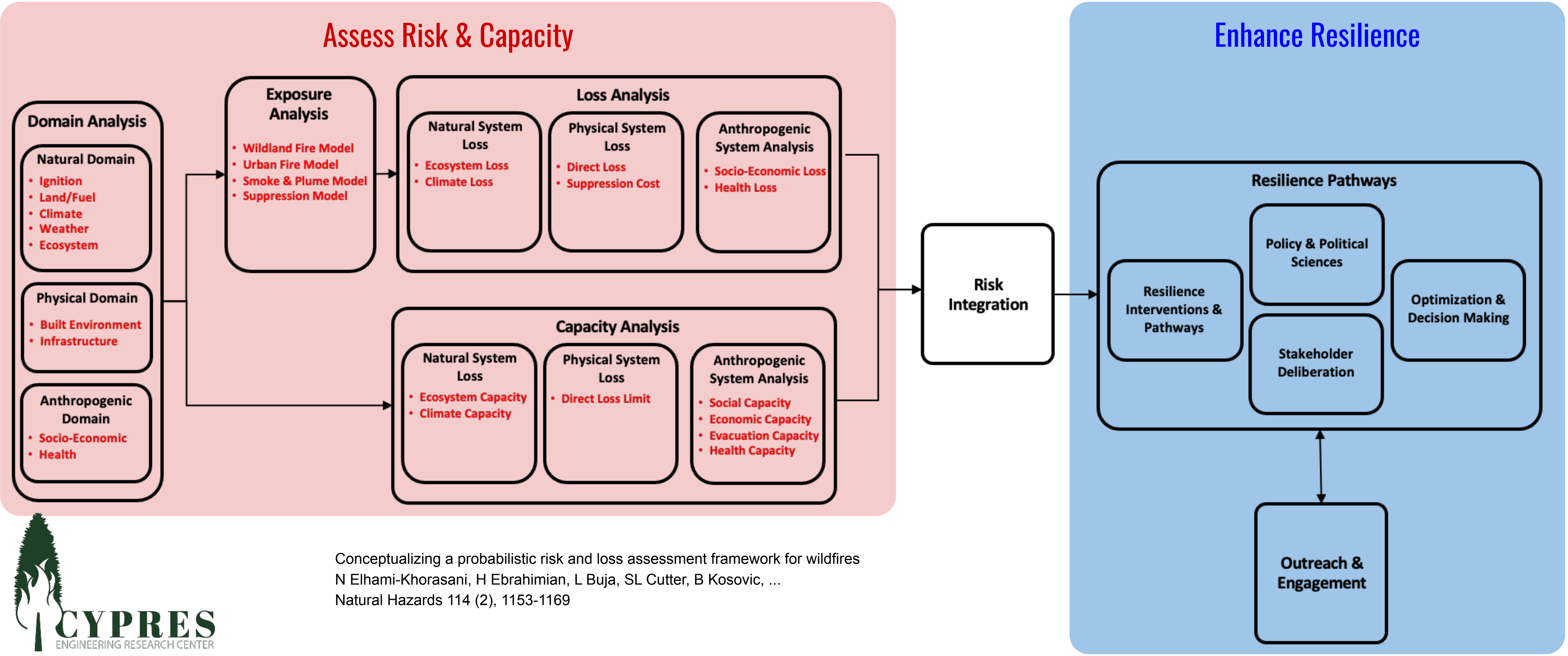
Capacity Assessment



Infographics: Headwaters Economics

CyPRES.Oracle

Open resilience assessment code library and environment



Conceptualizing a probabilistic risk and loss assessment framework for wildfires
N Elhami-Khorasani, H Ebrahimian, L Buja, SL Cutter, B Kosovic, ...
Natural Hazards 114 (2), 1153-1169

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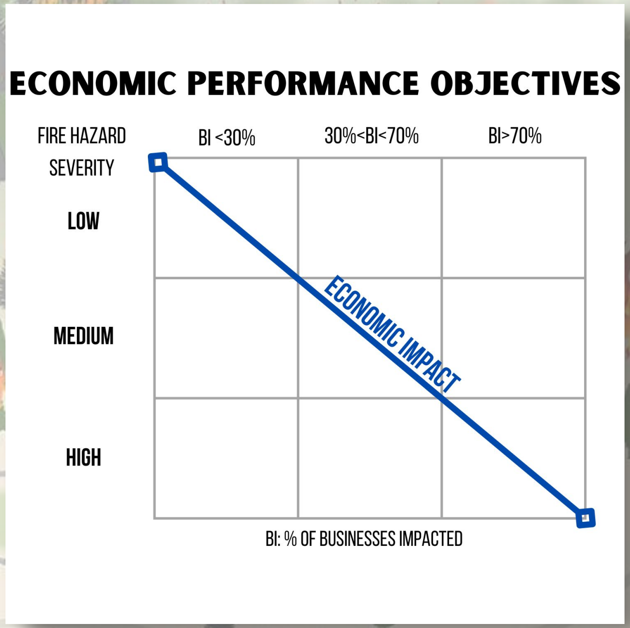
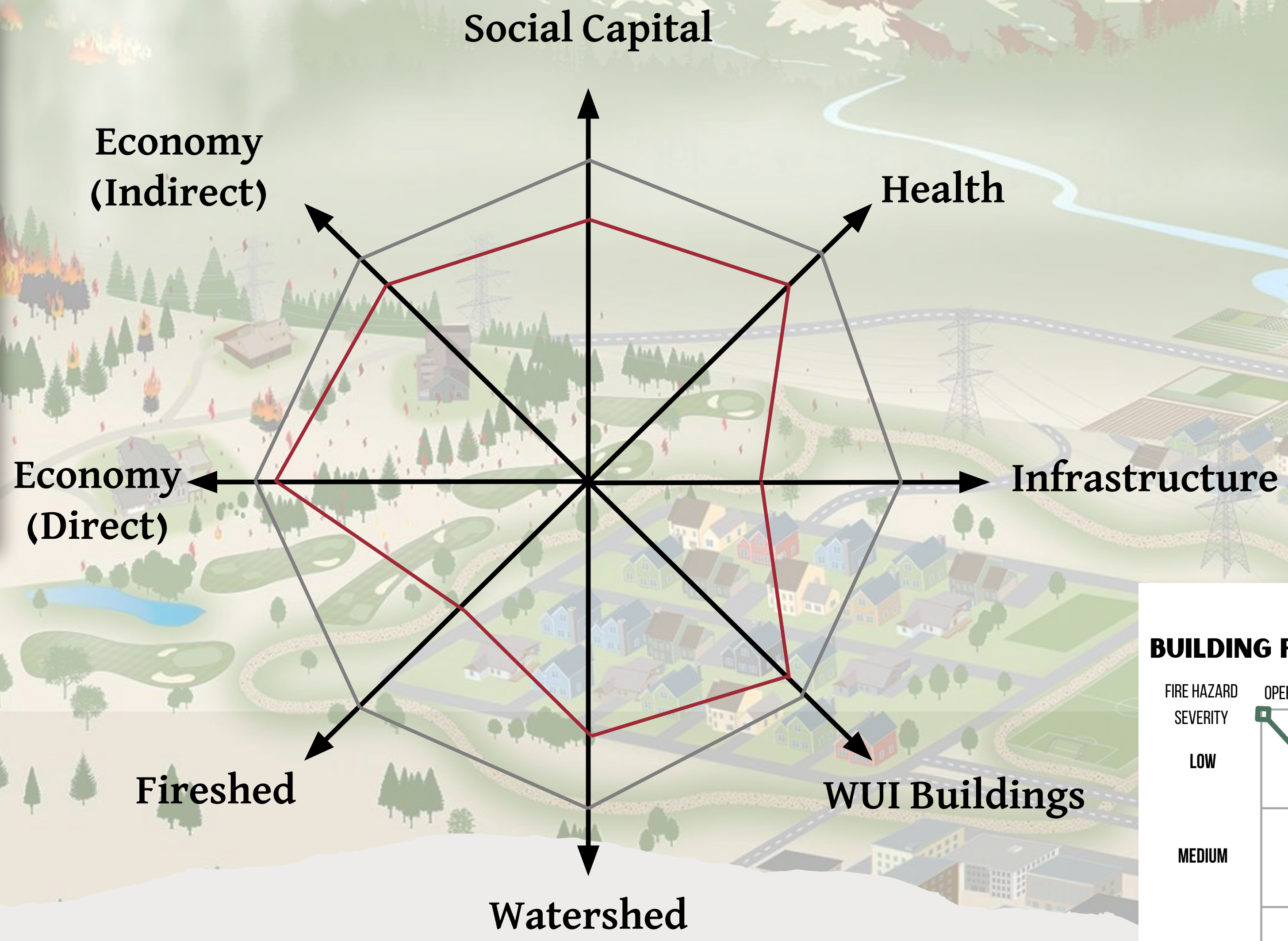
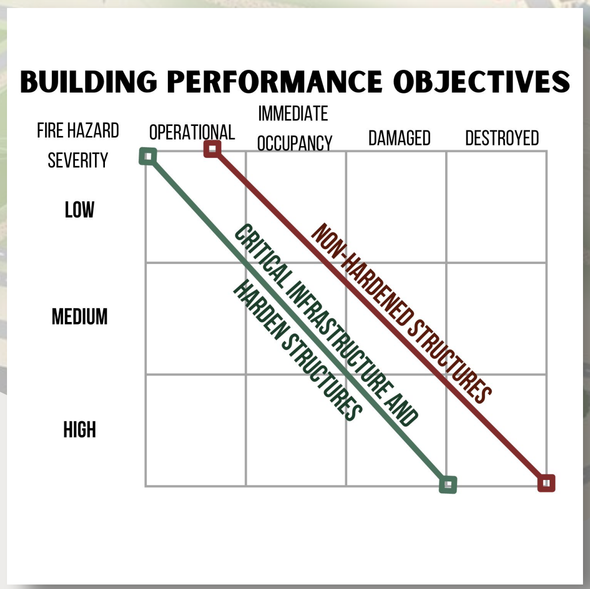
Infographic: Headwaters Economics







Co-develop Performance Objectives with Communities and Stakeholders

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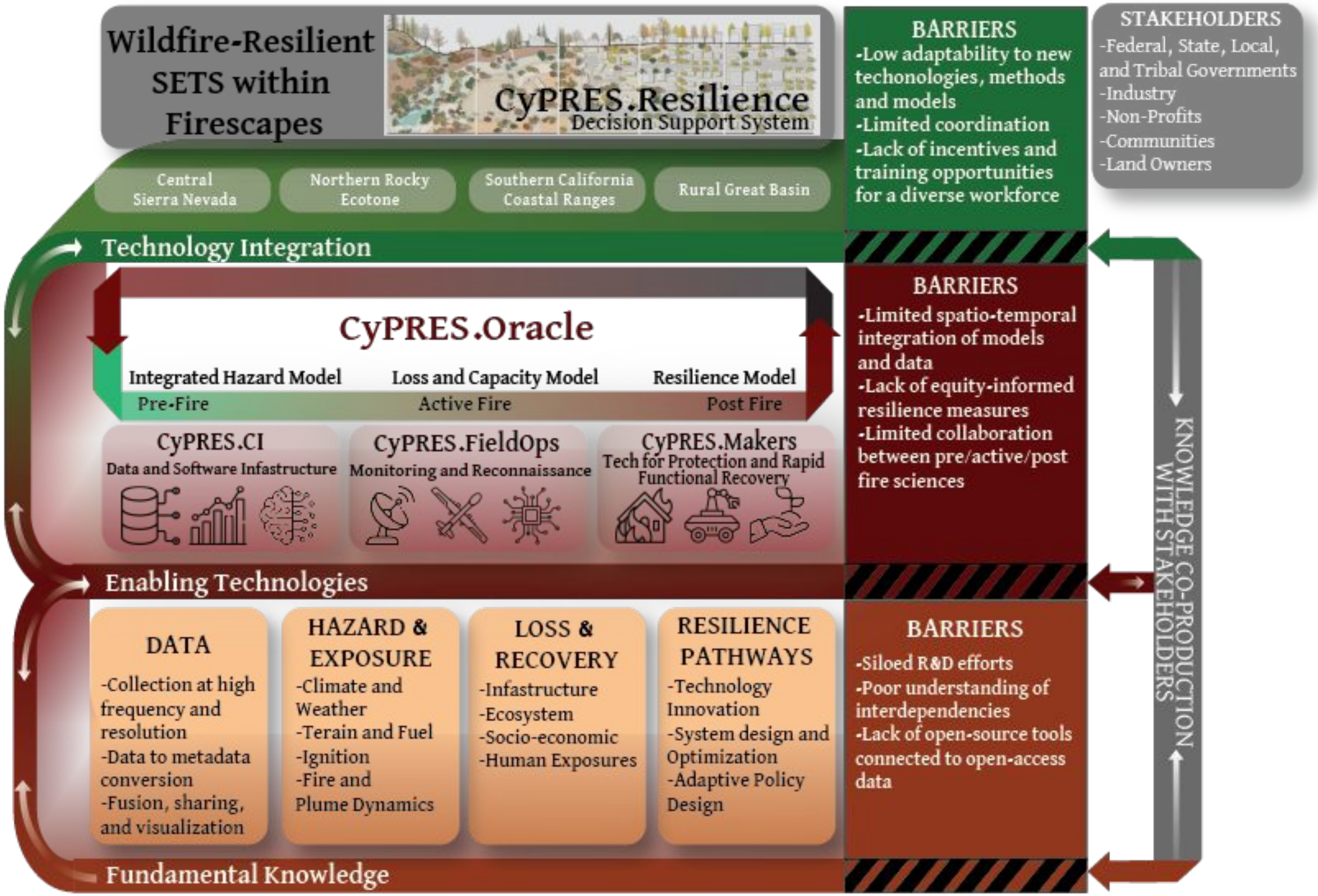

Wildfire-Resilient SETS within Firescapes
CyPRES.Resilience
Decision Support System
BARRIERS
-Low adaptability to new techonologies, methods and models
-Limited coordination
-Lack of incentives and training opportunities for a diverse workforce
STAKEHOLDERS
-Federal, State, Local, and Tribal Governments
-Industry
-Non-Profits
-Communities
-Land Owners
Central Sierra Nevada
Northern Rocky Ecotone
Southern California Coastal Ranges
Rural Great Basin
Technology Integration
CyPRES.Oracle
Integrated Hazard Model
Loss and Capacity Model
Resilience Model
Pre-Fire
Active Fire
Post Fire
BARRIERS
-Limited spatio-temporal integration of models and data
-Lack of equity-informed resilience measures
-Limited collaboration between pre/active/post fire sciences
CyPRES.CI
Data and Software Infastructure
CyPRES.FieldOps
Monitoring and Reconnaissance
CyPRES.Makers
Tech for Protection and Rapid Functional Recovery
KNOWLEDGE CO-PRODUCTION WITH STAKEHOLDERS
Enabling Technologies
DATA
-Collection at high frequency and resolution
-Data to metadata conversion
-Fusion, sharing, and visualization
HAZARD & EXPOSURE
-Climate and Weather
-Terain and Fuel
-Ignition
-Fire and Plume Dynamics
LOSS & RECOVERY
-Infastructure
-Ecosystem
-Socio-economic
-Human Exposures
RESILIENCE PATHWAYS
-Technology Innovation
-System design and Optimization
-Adaptive Policy Design
BARRIERS
-Siloed R&D efforts
-Poor understanding of interdependencies
-Lack of open-source tools connected to open-access data
Fundamental Knowledge

Who are we?

Ertugrul Taciroglu
UCLA
Research Interests: Regional Natural Hazard Risk Assessment. Computational Science & Engineering

Hamed Ebrahimian
University of Nevada, Reno
Research Interests: Risk assessment/decision making under uncertainty, integration of computational models with data/Digital Twins

Negar Elhami-Khorasani
University at Buffalo
Research Interests: Fire engineering; resilient communities; cascading hazards

Alistair Smith
University of Idaho
Research Interests: Combustion physics Wildland fire science, Forest biometrics

Alark Saxena
Northern Arizona University
Research Interests: Forestry; Sustainability;, Disaster Risk Reduction, Social-ecological resilience

Rachael Brady
UCLA
Former CAL FIRE Research Data Specialist and 9-1-1 Dispatcher

Paolo Gardoni
University of Illinois
Research Interests: Risk and reliability, Natural hazard resilience


University of Idaho
University at Buffalo
University of Illinois Urbana-Champaign
University of Michigan
National Center for Atmospheric Research
University of Nevada, Reno
University of Utah
UC Davis
Northern Arizona Unversity
UCLA
UC Santa Barbara
University of Southern California
University of South Carolina
TACC
UNITED STATES
Lead Institute
Core Partner
Collaborting Partners

Foundational Pillars of an ERC

CONVERGENT RESEARCH

ENGINEERING WORKFORCE DEVELOPMENT

DIVERSITY AND CULTURE OF INCLUSION

INNOVATION ECOSYSTEM

Research Thrusts

HAZARD AND EXPOSURE

LOSS AND RECOVERY

RESILIENCE PATHWAYS

DATA

Research Thrust

Hazard and Exposure

Researchers

Negar Elhami-Khorasani

Branko Kosovic

Name	Affiliation	Department/School	Area of Research
Hazard and Exposure			
Negar Elhami-Khorasani	**UB**	**Civil, Structural and Environmental Engineering**	**WUI communities, resilience**
Branko Kosovic	**NCAR**	**Director of the Weather Systems and Assessment Program**	**Wildfire modeling**
Hamed Ebrahimian	UNR	Civil and Environmental Engineering	Risk assessment, resilience, Rapid Response Technology
Qing Zhu	UCLA/LBNL	Wildfire Group	Ignition ++
Andy Thode	NAU	School of Forestry	Fire Ecology and Management, Fire Science, Burn Severity
Melissa Bukovsky	NCAR		Regional Climate Model, climate analysis and climate change impacts
Jacquelyn Shuman	NCAR		Land Fuel Model
Zhenduo Zhu	UB	Civil, Structural and Environmental Engineering	Suppression modeling, solutions, and impacts
George Gross	UIUC	Electrical & Computer Engineering	
Rajesh Kumar	NCAR		Air Quality Model

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Objectives & Scope

The **objective** of the **Hazard and Exposure** research thrust is to establish high-fidelity, scalable, and dynamic simulations of “climate and land”, “fire ignition and propagation”, and “plume dynamics”, for which the uncertainties and modeling errors will be quantified.

A framework will be developed to link the ***macroscopic*** modeling of regions with the ***microscopic*** modeling of individual houses in a WUI community.

Sample projects:

H&E 1: Wildfire hazard predictions and projections considering climate change

H&E 2: Interdependencies between wildfire and power network pre- and post-ignition

H&E 3: Behavior of destructive wildfires

H&E 4: Predicting wildfire impacts on air quality

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Current Gaps

There is a large body of literature related to wildfire hazard and exposure analysis but there are still no researched and validated predictive models that integrate and connect processes at different spatial and temporal scales from climate to ignition of individual structures that could be used for wildfire resilience assessment.

Hazard and Exposure will generate **fundamental knowledge** on

(1) the role of human activities on the pattern and likelihood of destructive wildfires,

(2) interdependencies between fire behavior and characteristics of urban communities, and

(3) predicting near-source and downwind transport and transformation of spatially and temporally varying fire emissions into criteria pollutants

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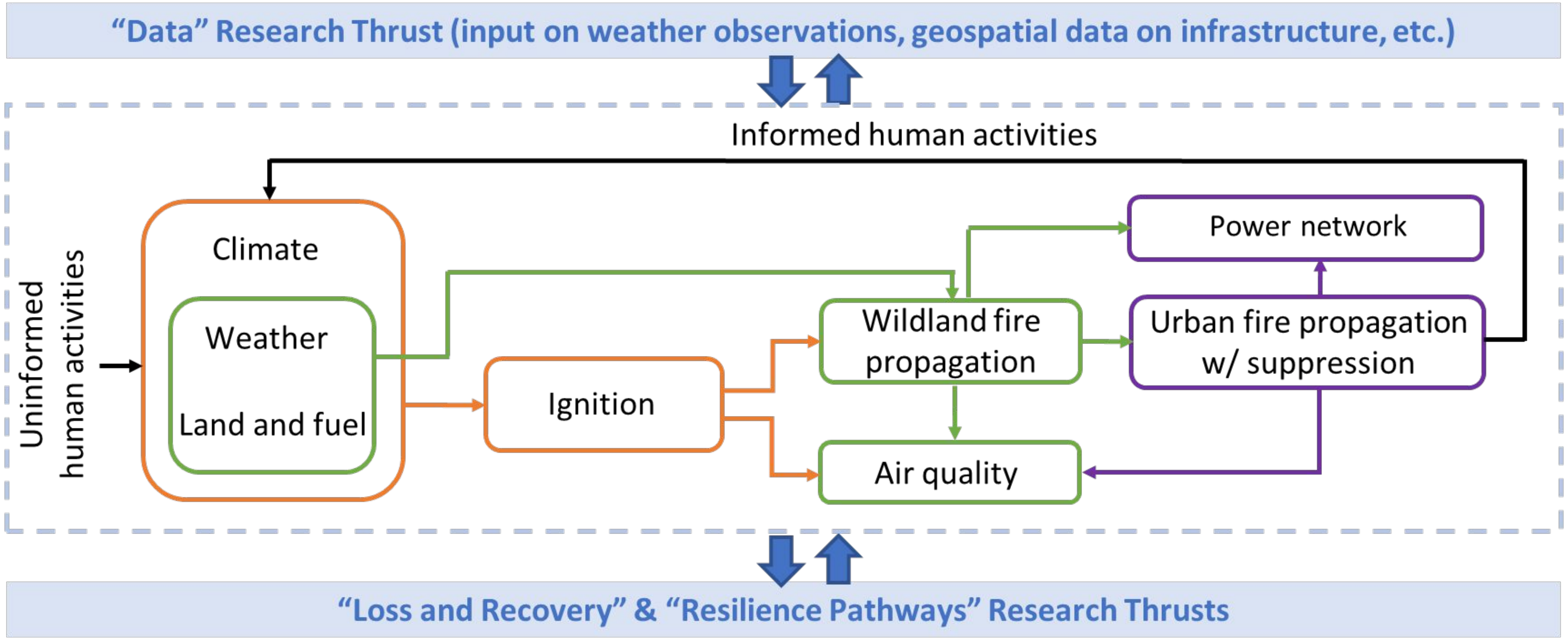
Contributions



Deliverables: validated simulation tools for continuous fire spread across wildland and communities, the likelihood of failure in the power grid, changes in air quality, and the effect of human actions on fire behavior in the wildland and urban areas considering climate change.

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Research Thrust

Loss and Recovery

Researchers

Paolo Gardoni

Susan Cutter

Name	Affiliation	Department/School	Area of Research
Loss and Recovery			
Paolo Gardoni	**UIUC**	**Civil and Environmental Engineering**	**Infrastructure resilience, reliability**
Susan Cutter	**University of South Carolina**	**Department of Geography**	**Social science**
Adam Rose	USC	School of Public Policy	Economics and Public Policy
Robert Shriver	UNR	Department of Natural Resources & Environmental Science	Impacts of environmental variability
Ben Sullivan	UNR	Natural Resources & Environmental Science	Land/fuel modeling
Erin Brooks	UI	Department of Soil and Water Systems	Complex ecosystems
Arden Rowell	UIUC	College of Law	Environmental law
Sudeep Chandra	UNR	Department of Biology	Aquatic ecosystems
Mariana Dobre	UI	College of Agricultural and Life Science	Hydrology
Regan Patterson	UCLA	Department of Civil and Environmental Engineering	Air quality
Paige Fischer	University of Michigan	School for Environment and Sustainability	Human dimensions of environmental change
Tom Cova	University of Utah	Department of Geography	Evacuation
Kirstin Dow	University of South Carolina	Geography	Adaptation, climate risk
Anthony Wexler	UC Davis	Mechanical and Aerospace Engineering	Air quality
Ryan Fitch	NAU	Department of Economics, Finance,and Accounting	Wildfire economics, ecological economics
Ian Sue Wing	Boston University	Earth and Environment	Climate policy models
Dan Wei	USC	Geography	Energy and Environmental Economics
Fynn Prager	CSUDH	Public Administration	Public policies

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Objectives & Scope

The ***Loss & Recovery Thrust*** will focus on

a) predicting the direct, indirect, short-, and long-term effects in the

1. built-environment domain
2. ecosystems domain
3. social domain
4. economic domain
5. human exposure domain

b) modeling the recovery of the impacted systems

The focus will be on the fundamental understanding and modeling of

1. the effects of fires on the built-environment (structures and infrastructure) considering the dependences among different elements and the service their provide to communities
2. identify short and long-term vulnerability and sensitivity to direct and cascading effects of wildfire in diverse ecosystems across spatial scales
3. place-based vulnerability and adaptive capacity of WUI communities, factors influencing mitigation and protective actions, social behavior during wildfires, and post-fire recovery time
4. regional and multi-regional direct and indirect economic impacts across sectors, regions, and socio-economic groups through advances in computable general equilibrium (CGE) models
5. impacts due to plume dispersion and concomitant human exposure measured through equity-informed metrics

The work will use the output from the Hazard & Exposure Thrust and provide input to the Resilience Pathway Thrust

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Current Gaps

- A significant body of research has proposed fire-adapted communities with a focus on reducing the vulnerability of individual structures, evacuation, or impacts of wildland fire management on communities, however, *no framework exists to quantify damage and recovery paths of the built environment after a wildfire that explicitly considers buildings, ancillary objects (e.g., yards, sheds), and critical infrastructure*
- An increase in the severity and frequency of wildfire with future climates has the potential to dramatically affect large ecosystems, however, *ecosystems in the western US have varying levels of resistance and resilience to fire and limited work has focused on a holistic assessment and prediction*
- As wildfire risk increases and impacts extend beyond the proximate area there is an upsurge in demand for putting people first in managing the risks especially among the most vulnerable households and communities who may be unlikely or unable to cope with and adapt to wildfire risk on their own, however, *there is a paucity of research on contextualizing the differences in communities in WUI regions exposed to wildfire risks based on their relative levels of social vulnerability and inherent resilience capacities*
- *There is a need to better understand the impact of wildfires on the economies at the regional and national level, and to develop models that can predict computationally the economic impact and recovery*
- *There is a need to improve exposure risk communication during wildfires and in anticipation of wildfire events, and better understand plume dispersion and concomitant human exposure*

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Contributions

This thrust will produce the fundamental knowledge and models for

1. the probability of damage and recovery time and cost of structures, infrastructure, and a community impacted by wildfires
2. the effects of large and severe fires on ecosystem processes and their recovery (e.g., soil and vegetation, habitat and species, water quality, landslide risk, timber/agriculture loss, and carbon sequestration)
3. place-based vulnerability and adaptive capacity of WUI communities, factors influencing mitigation and protective actions, social behavior during wildfires, and post-fire recovery time
4. regional and multi-regional direct and indirect economic impacts across sectors, regions, and socio-economic groups through advances in computable general equilibrium (CGE) models
5. impacts due to plume dispersion and concomitant human exposure measured through equity-informed metrics

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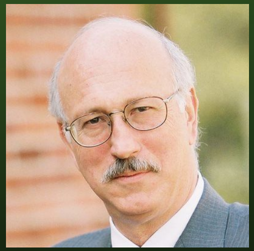
Research Thrust

Resilience Pathways

Researchers


Alistair Smith


Adam Rose

Name	Affiliation	Department/School	Area of Research
Resilience Pathways			
Alistair Smith	**UI**	**College of Natural Resources**	**Wildland fire science**
Adam Rose	**University of Southern California**	**School of Public Policy**	**Economics**
Dan Wei	University of Southern California	School of Public Policy	Policy / Economics
Ali Mosleh	UCLA	Civil and Environmental Engineering	Risk and reliability
Tarannom Parhizkar	UCLA	Civil and Environmental Engineering	
Alark Saxena	NAU	School of Forestry	Socio-ecological resilience
Rajan Batta	UB	Industrial and Systems Eng. and Associate Dean for Faculty Affairs and Diversity	Education and workforce + system integration
Colleen Murphy	UIUC	College of Law	Legal and ethical dimensions of risks

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Objectives & Scope

The **_Resilience Pathways Thrust_** will focus on co-developing, with the Testbed Communities, feasible solution pathways for wildfire resilience.

- Create "Blueprints for Resilience"
- Identify Intervention Capabilities
- Assess Tradeoff Scale and Dimensions
- Quantify Tradeoff Impacts
- Ensure Sustainability and Equity
- Construct Regional Economic Models

The focus will be on identifying and modeling:

1. Plausible pathways that align with what community groups consider as wildfire resilience from the infinite set of possible solutions.
2. Magnitude, frequency, and timing of plausible interventions to achieve resilience pathways.
3. Scales (spatial and temporal) and dimensions (governance, values, resources, etc.) drivers and factors that impact tradeoff decisions.
4. Tradeoffs and costs (economic, resource, trust, etc.) between different plausible interventions and pathways.
5. Approaches and strategies to ensure sustainability and equity of tradeoff decisions, including mitigation pathways, especially when tensions may arise between stakeholders.
6. Project example: Construct regional economic models of Testbed economies, including use of survey data, to project future baselines and trade-offs.

The research will use the outputs from the Hazards & Exposure Thrust, Loss & Recovery Thrust, and Knowledge Co-Production (KCP) group and will provide iterative inputs to all the other Thrusts.

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Current Gaps

- Key knowledge barriers exist in our understanding of the multisystemic resilience of socio-ecological, economic and technological systems to wildfires.
- Most research has focused on interventions on wildland fuels prior to the fire. We **urgently** need to assess dynamic interventions, as communities and landscapes can exhibit different problem scales and capacities to adapt, absorb, and recover from wildfires.
- Although we manage lands for multiple objectives, most research has focused on how fires impact single ecosystem goods or services and rarely examines tradeoffs between different decision pathways.
- We need to understand how tradeoffs between different values of interest (e.g., timber, real estate, tourism) and pathways with varying dynamic technological interventions (i.e., at multiple timepoints in the pre- to post-fire continuum) impact the ability of a community to mitigate in advance of a fire, recover and improve resilience to future wildfires.
- Although considerable research has focused on how individuals and communities can prepare and respond to wildfires, existing typologies do not provide what is required to be able to fully analyze interventions and tradeoff decisions across scales.
- Knowledge is limited of how sustainability and equity influence the ability of individuals, communities, and business/amenities that focus on a range of ecosystem goods and services to rebound rather than collapse following wildfires.
- Overall, these knowledge gaps limit the ability to assess the extent to which selection of various pathways, including static/dynamic interventions, influence the ability of diverse communities to absorb, recover, or adapt and transform to future wildfire scenarios.

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Contributions

This thrust will produce the fundamental knowledge to:

- Assess the role that trade-offs, available resources, and changes in SETS, including capacity, governance dynamics, demographics, technological accessibility, etc., play in determining resilience strategies to future wildfires.
- Advance modeling and data visualization technologies (e.g., virtual reality, extended reality) to facilitate convergence and improve the understanding of how interventions across scales can improve or impair varying community values, visions, and plausible resilience pathways.
- Identify what approaches best increase stakeholder co-production (particularly from the perspective of diversity and inclusion) in resilience analysis.
- Identify key methods to enable long-term monitoring and evaluation of resilience tradeoffs and pathways for achieving current and future community wildfire resilience visions.
- Co-develop an advanced typology of communities vulnerable to wildfires.
- Construct dynamic economic models of forest-based economies for projection and analysis.

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Research Thrust - Enabling Technology

Data and Infrastructure

Researchers


Tim Cockerill


Mohamad Alipour

Name	Affiliation	Department/School	Area of Research
Software and Data			
Tim Cockerill	**TACC**	**User Services (Director)**	**Web-based platform supporting natural hazards research**
Mohamad Alipour	**UIUC**	**Civil and Environmental Engineering**	**Construction Materials, Sustainable and Resilient Infast**
Paul Navratil	TACC	Strategic Technologies	Hardware, software, data, analysis and UI/UX
John Anderson	University of Idaho	Virtual Technology & Design	Virtual reality
Roger Lew	University of Idaho	Virtual Technology & Design	Virtual reality, Sociotechnical systems
Frank McKenna	UC Berkeley	NHERI SimCenter	Software and data

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Data and Infrastructure

HIGH PERFORMANCE COMPUTING

DATA MANAGEMENT

WEB PORTAL

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High Performance Computing

Frontera

- 8,360 primary compute nodes – 40PF, >1.5PB of RAM, 60PB scratch, 3PB fast (flash) scratch, fast interconnect.
- 2 Intel Cascade Lake processors, 56 cores, 192GB of RAM per node.
- Normal production runs to 2k nodes which is >100k cores.
- 16 NVDIMM nodes – 6TB of RAM or fast storage.90 4x GPU nodes – 360 RTX 5000 oil-cooled GPUs.

Lonestar6

- 560 nodes, each with 2 AMD EPYC 64-core processors.
- GPU subsystem – 80 nodes, x3 NVIDIA Ampere A100 GPUs per node (120GB GPU memory, 256GB main memory per node).

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Data Management/Storage

Tiered approach to storage

HPC

- /tmp – each server on an HPC system, temporary, not shared.
- /scratch – shared for all users on each HPC system, up to 100 Petabyte capacity, short duration for while you are running.
- /work – mounted on all HPC systems, intermediate term working space (multi-year, no backups, relatively performant).

Data Collections

- Publish/Share – Corral – web accessible, high integrity, 50PB capacity – this is where data from major projects like CyPRES lives.
- Tape Archive – Ranch - lower performance, effectively infinite (currently 200PB, should hit 1 Exabyte in next 4 years). In service since 1986 and counting.

Protected Data

- Important for wildfire social science researchers
- Support many types including IRB, PII, HIPAA, FERPA

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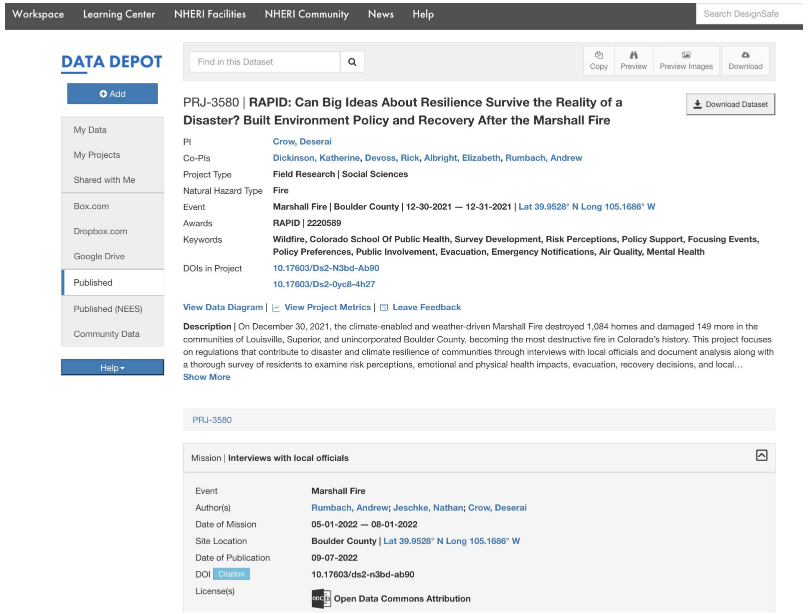
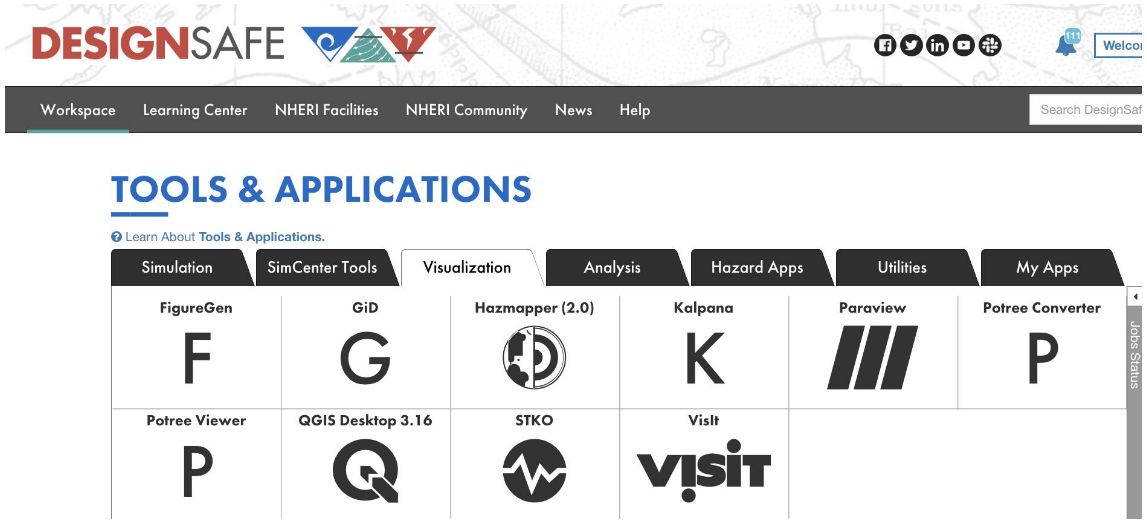
Web Portal





- Enable research workflows and access to high performance computing (HPC)
- Deliver web-accessible tools supporting analysis, visualization, and integration of diverse data types including ***specialized GIS applications***
- Provide a platform for data sharing/publishing

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And People

Access to TACC's ~200 professional staff

Roughly a third of our staff are experienced computational researchers and all of us provide support to the research community

Provide expert consulting and assistance including AI-focused support, hyperparameter tuning, performance optimization

Provide training on using the CyPRES cyberinfrastructure

Provide a dedicated queue in ticketing system for tracking issues and resolution

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Enabling Technology

Makers

Researchers

Sriram Narasimhan

Lili Cai

Name	Affiliation	Department/School	Area of Research
Software and Data			
Sriram Narasimhan	UCLA	Department of Civil and Environmental Engineering	Smart infrastructure
Lili Cai	University of Idaho	Department of Forest, Rangeland and Fire Sciences	Bio-based fire retardants

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Objective & Scope

The **objective** of the **CyPRES.Makers** enabling technology is to develop, test and validate technologically-driven solutions to wildfire risks and for resilience assessment in the pre-fire and post-fire scenarios

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Current Gaps

An integrated technology-driven multiresolution framework incorporating sensed data and probabilistic models to inform risk and resiliency predictive models in pre and post-fire phases does not exist

Low-cost ubiquitous sensors relevant to pre and post fire hazard and resilience assessments and which can operate for long periods of time in resource-scarce (energy and bandwidth) environments is lacking

Algorithms that can mine pertinent information from multi-spectral and lidar data to inform predictive fire models in the context of WUI needs significant development

Testing and field validation of sensing technologies in relevant environments is lacking; contextualization and visualization of such data required for training and planning activities is also lacking

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Contributions

Develop, test and validate new sensors and sensing systems which can support predictive simulation models (Oracle), rating systems, and provide unprecedented insights into identifying and mitigating primary risk and resilience drivers in the pre and post fire phases

Develop new mathematical models and algorithms for state estimation and inference from observed data, including but not limited to robot and environment state estimation, machine learning, and probabilistic decision-support methods

Develop tools that harness the power of immersive environments such as VR and AR that will enable various stakeholders (e.g., researchers, policy makers, fire fighters) better visualize simulations, contextualize data, teleoperate sensing platforms, and train personnel involved in fire risk mitigation and community resilience planning activities.

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Enabling Technology

Field Operations

Researchers

Neil Lareau

Sudeep Chandra

Name	Affiliation	Department/School	Area of Research
Field Operations			
Neil Lareau (Field Ops)	UNR	Department of Physics	Lidar/Radar and fire data
Sudeep Chandra (Field Ops)	UNR	Natural Resources & Environmental Science	Watershed & Ecology

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Objective & Scope

The **objective** of the **CyPRES.FieldOps** quantify wildfire plume dynamics and fire generated winds to improve model development of fire impacts to regional processes, the downwind distribution of hazardous smoke and fall-out of ash and debris from wildfire plumes, and the immediate impacts to regional water quality and quantify

Current Gaps

Fire-generated circulations (updrafts and inflows) feedback on fire rate and direction of spread. Fire generated updrafts also loft embers, yielding non-linear fire progression and the development of mass fire. These are poorly understood processes that are insufficiently represented in most operational models, including coupled fire-atmosphere simulations.

Wildfire plumes transport hazardous levels of particulate pollution (i.e., PM2.5, metals, organic pollutants) to regions downwind from active fires, impacting human health and natural ecosystems. These plumes also transport coarse debris and ash (mm and larger material), referred to as pyrometeors. The fall out of these pyrometeors can also critically impact the chemistry and biology of aquatic and terrestrial ecosystems lingering from days to years as impacts in waterways.

Need to fill in gaps on model process that yield predicts of transport and impacts to human systems visualizing the changes that are generated from fire-generated circulations.

Use these predictions as a tools to engage with fire management and impact assessment.

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Contributions

Deploy rapid response teams that will examine and contrast the dynamics with different initial characteristics in topography, vegetation, and density of human habitation. We will deploy a combination of a) lidar and radar remote sensing of plume processes, b) in-situ monitoring of smoke concentration and ash particle distributions, c) incident surface light, and c) water sensors proximate to the watershed and outside of the watersheds exhibiting high impact burning.

We will integrate the data collections with the cyberinfrastructure team which can help visualize wildfire movement, plume development and regional dispersion, on the ground changes to incident light, water quality (temperature, oxygen, conductivity), and changes to quantify.

We do anticipate equipment requests to the National Science Foundation supported DesignSafe-CI to support field actions related to wildfire hazards. We want to integrate with the knowledge co-production/ social science team to convey information to the communities if this helps them to understand the impacts and visualize the impacts of wildfire but we presume this will be integrated through The Oracle.

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Testbeds

Researchers

Alark Saxena

Loretta Singletary

Name	Affiliation	Department/School	Area of Research
Testbeds and Co-Production			
Alark Saxena	**NAU**	**School of Forestry**	**Social-ecological resilience**
Loretta Singletary	**UNR**	**Economics**	**Knowledge Co-Production, Stakeholder Outreach**
Christina Restaino	UNR	Living with Fire	Community Outreach / Policy

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Criteria for Testbed Selection

- SETS
- Fire Regime
- WUI
- Vulnerability
- Operationalizability
- Complexity
- Representation

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Testbeds

Years 1-5

1. Central Sierra
2. Northern Arizona
3. Northern Rocky Ecotone

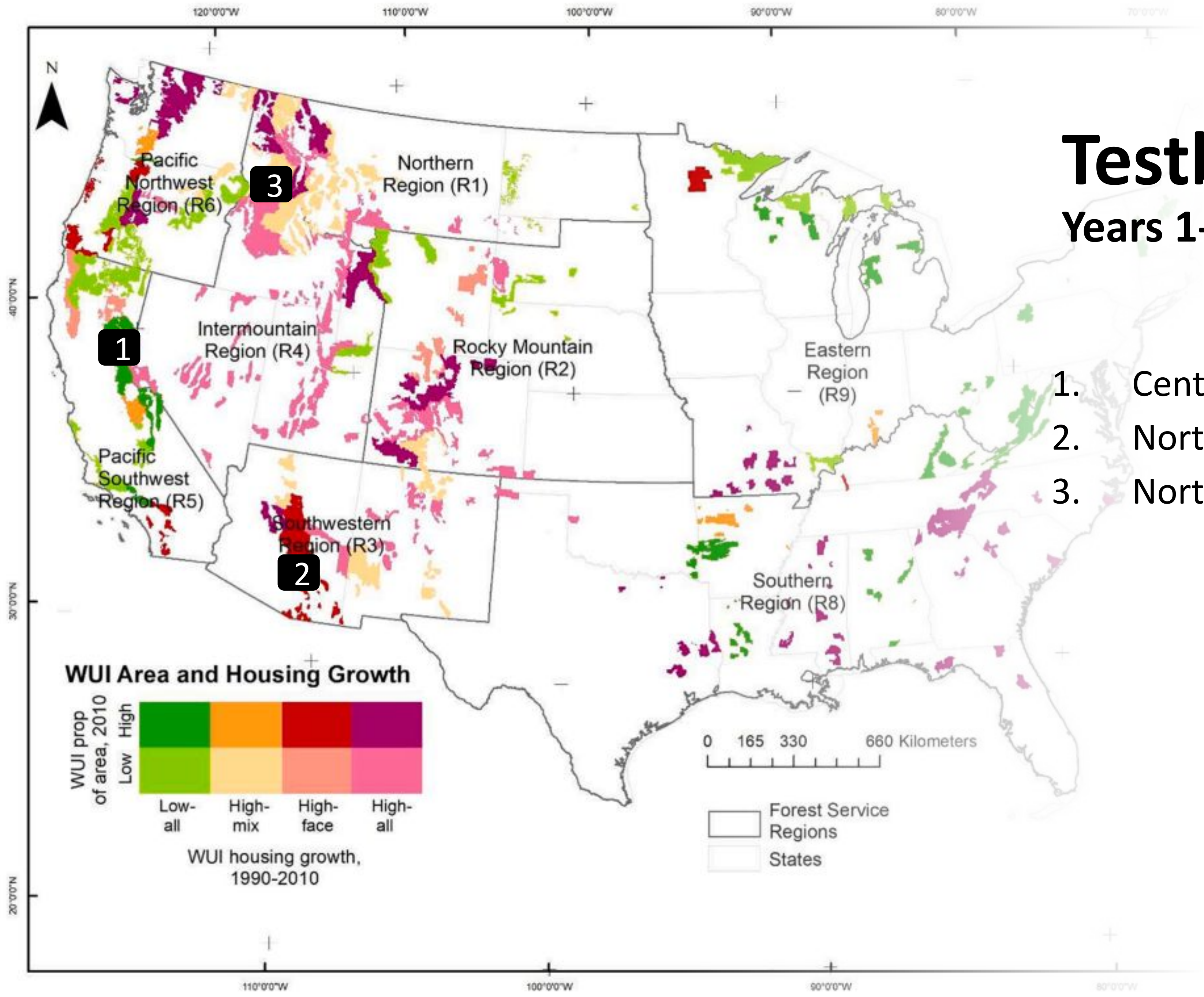

Fig. 1. Typology of wildland urban interface (WUI) area and growth for individual National Forests and regions, showing WUI area (2010) and le

Knowledge Co-Production Methods in Testbeds

1 → 2 → 3

Phase I - Assess Local Needs and Vision
Identify and engage TAGs across 3-4 communities per testbed via focus groups

- Focus group data analyzed and results shared with science team and TAGs
- identify research agenda, Oracle development focused on co-produced **vision** for wildfire resilient future
- Convergence across DEI, Workforce development and Resilience pathways

Phase II – Assess Local Needs and Vision
Virtually engage broader testbed actors to inform convergence research agenda/direction

- E-survey question items co-produced using focus group results across all 3 testbeds
- E-survey results used by science team to inform/shape research and Oracle

Phase III - Validate, Evaluate and Disseminate
Virtual KCP sessions w/ TAG to verify convergence research findings to date, including Oracle

- Pilot Oracle decision-support-tool in its infancy developmental stages with potential end-users
- Evaluate veracity of KCP methods and typology that best align with testbed wildfire regimes
- Evaluate ERC science team's KCP experiences contributing to convergence leading to Oracle

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