National Institute of Standards and Technology
U.S. Department of Commerce

NIST WUI FIRE DAYS 2022

Enhancing Life Safety and Reducing WUI Fire Loses

NIST WUI Research Overview

July2022

NIST National Institute of Standards and Technology U.S. Department of Commerce

2022 | NIST WUI DAYS 2022 | 2023 | 2024 | NIST WUI DAYS 2024

Case Studies

FALL 2022

CAMP #4 NETTRA – Notification/ Evacuation/ Traffic and Temporary Refuge Areas

CAMP #5 Emergency Response/ Defensive Actions and Damaged Structures

Hazard Mitigation Methodology (HMM)

NIST TN 2205

SPRING 2023

Graphical User Tool

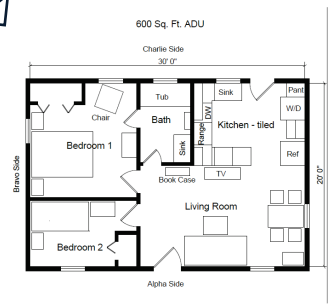
Laboratory Research

SSE

SPRING & FALL 2022

Sheds

RVs, ADUs and Single Family



Fences, Wood Piles

Emberometer

Sealants and Gaskets

Fed: IWG (including FEMA, USFA, HUD)
States: CA, OR, WY, CO, SC
Codes and Standards/ Best Practices
CA Chapter 7A & Chapter 49
ICC IWUI
NFPA 1140 & Firewise

HMM CAMP SSE

engineering laboratory

Agenda

NIST WUI FIRE DAYS 2022

Research Presentations Agenda

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Day 3 — July 20, Starting at 1:00 pm Eastern

Session	Time (ET)	Title
3.0	1:00 – 1:15 (15 min)	Parcel-level Hazard Mitigation Introduction
3.1	1:15 – 2:10 (55 min)	NIST Fences Research and Findings
	2:10 – 2:15 (5 min)	Break
3.2	2:15 – 2:50 (35 min)	NIST Emberometer Research
3.3	2:50 – 3:25 (35 min)	2012 Waldo Fire (CO) Case Study
	3:25 – 3:35 (10 min)	Q&A
	3:35 – 3:40 (5 min)	Break
3.4	3:40 – 4:00 (20 min)	HMM WUI Structure/Parcel/Community Design Considerations
3.5	4:00 – 4:10 (10 min)	Closing Remarks – NIST EL Director

Total Day 3: 3 h 10 min

Day 4 — July 27, Starting at 1:00 pm Eastern

NIST Grantees Presentations

Session	Time (ET)		Title
4.0	1:00 – 1:10	(10 min)	WUI Fire-related NIST Grants Introduction
4.1	1:10 – 1:55	(45 min)	WUI-NITY 3: Multi-method traffic movement data collection for WUI fire evacuation modeling – *Prof. Steve Gwynne Ph.D., Lund University*
	1:55 – 2:05	(10 min)	Q&A
	2:05 – 2:10	(5 min)	Break
4.2	2:10 – 2:55	(45 min)	Developing AI-Based Wildfire Evacuation Behavior (AI-WEB) model – *Prof. Xilei Zhao Ph.D., University of Florida*
	2:55 – 3:05	(10 min)	Q&A
	3:05 – 3:10	(5 min)	Break
4.3	3:10 – 3:55	(45 min)	Measuring source terms of firebrand generation numbers for physics-based models – *Prof. David Blunck Ph.D., Oregon State University*
	3:55 – 4:05	(10 min)	Q&A
	4:05 – 4:10	(5 min)	Break
4.4	4:10 – 4:55	(45 min)	Quantification of firebrand production from WUI fuels for model development – *Prof. Michael Gollner Ph.D., the University of California, Berkeley*
	4:55 – 5:05	(10 min)	Q&A
4.5	5:05 – 5:15	(10 min)	Closing Remarks

Total Day 4: 4 h 15 min

Parcel Level Hazard Mitigation
NIST WUI FIRE DAYS 2022

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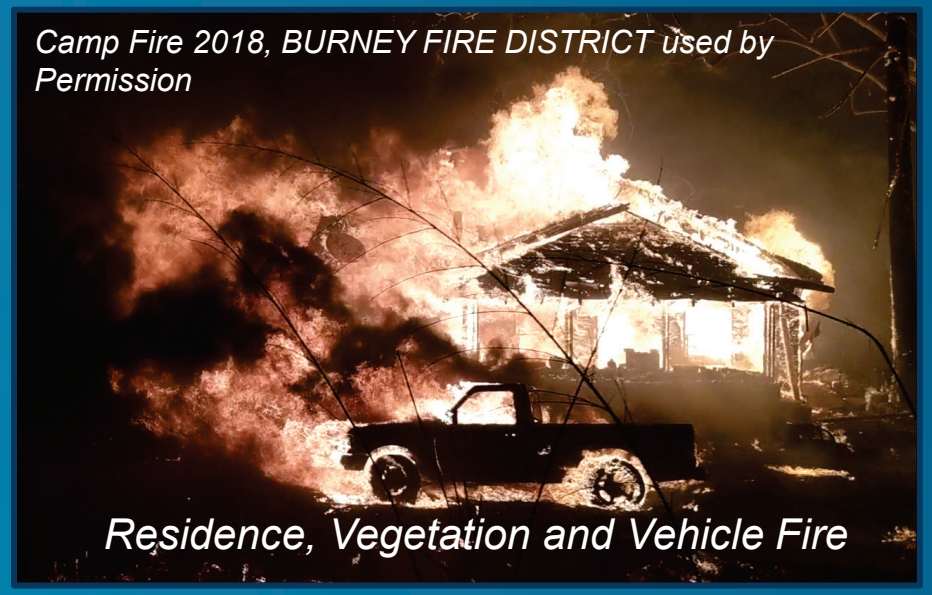
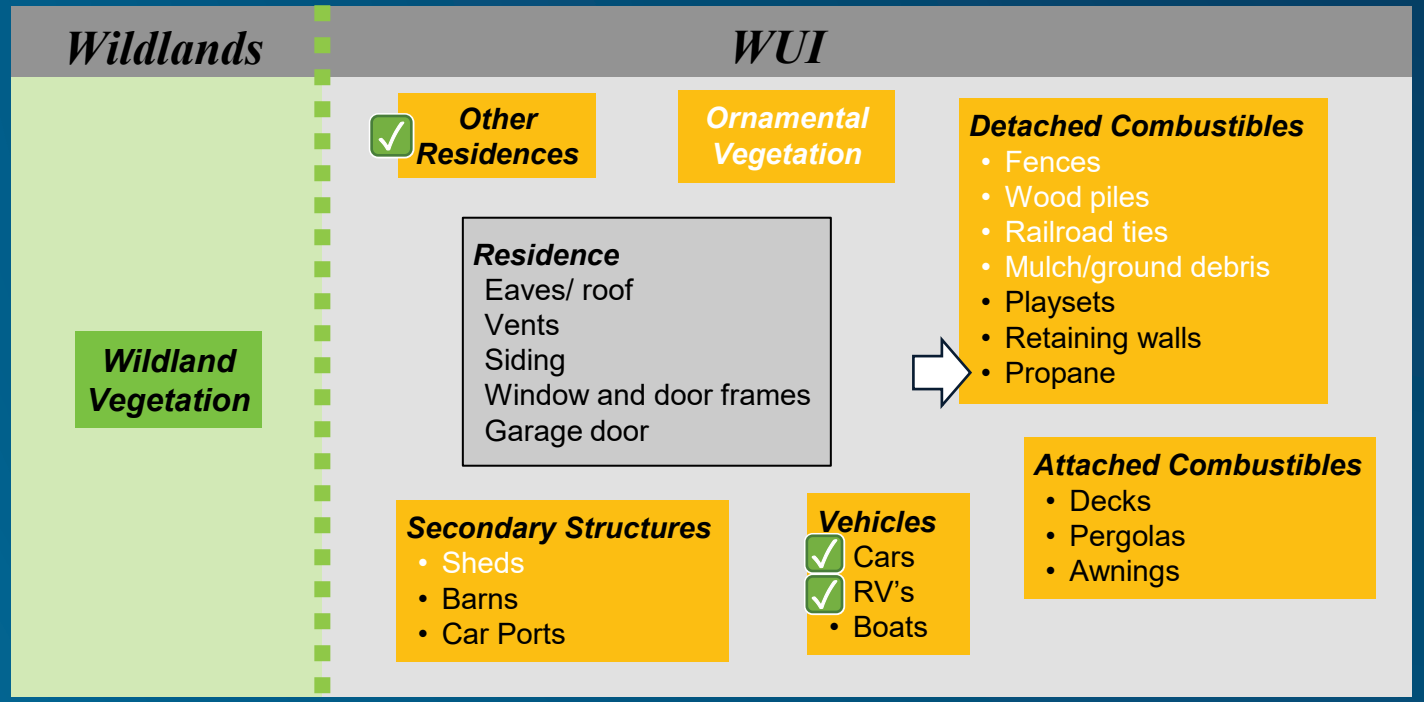




- Local conditions will drive ember exposures to specific structure elements. Extreme variability influence actual exposures.

- *Source placement* (and local wind) will drive fire exposures to specific structure elements.

☑ Planned SSE research

WUI Fires – Structure Ignition Hazard Mitigation

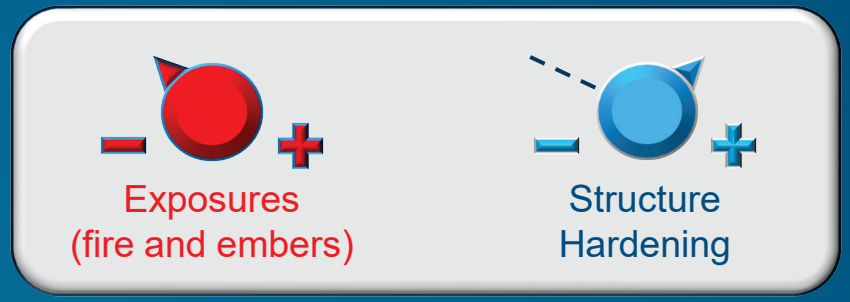
Existing Buildings/Communities

- Limitations to exposure reduction - existing Structure Separation Distance (SSDs)
- Limited ignition resistance

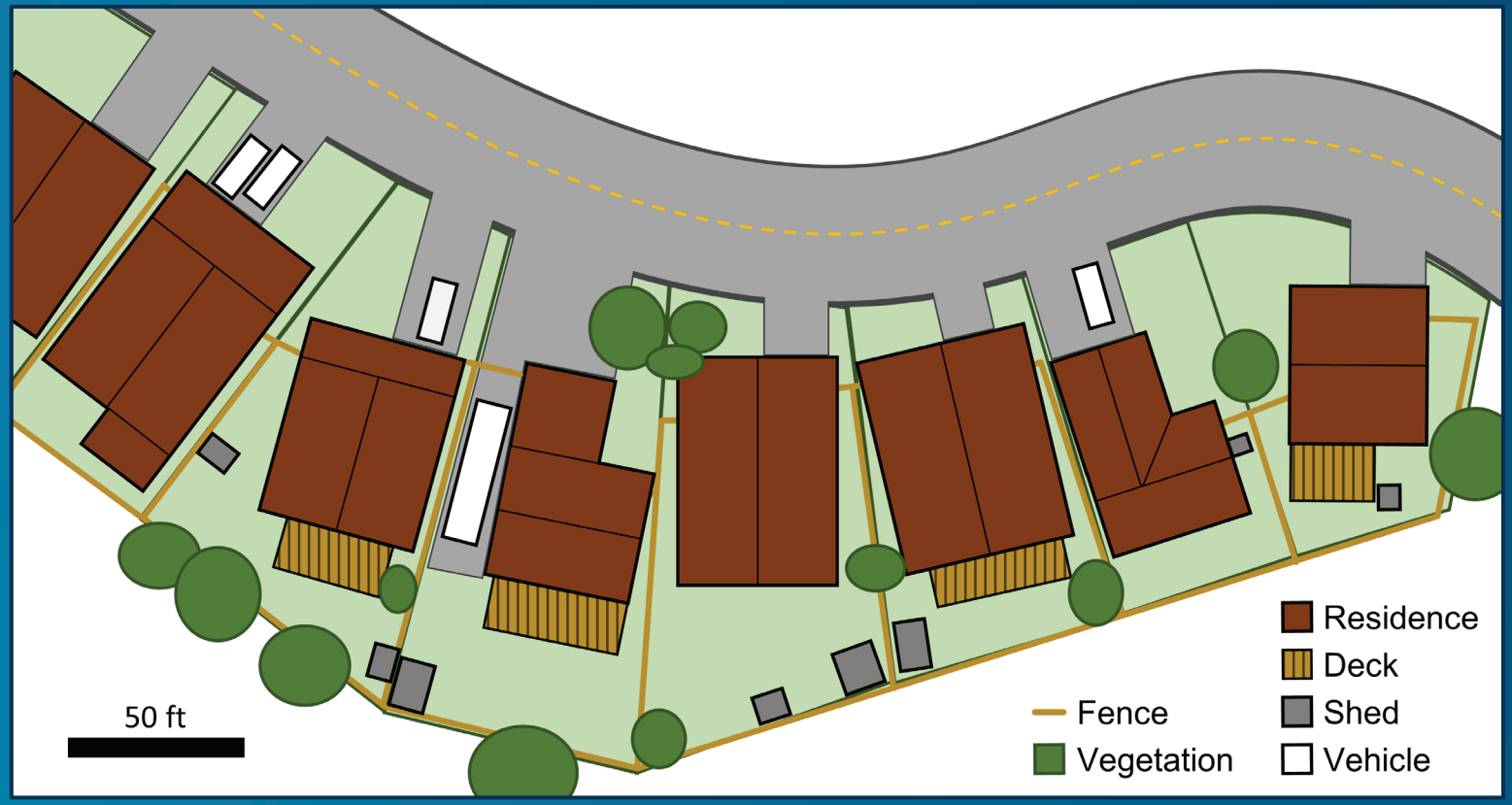
- Transition from parcel to multiparcel hazard assessment and mitigation needed
- Lifestyle - paradigm shift needed
- Large building stock – cost effective hardening/funds needed

New Buildings/Communities

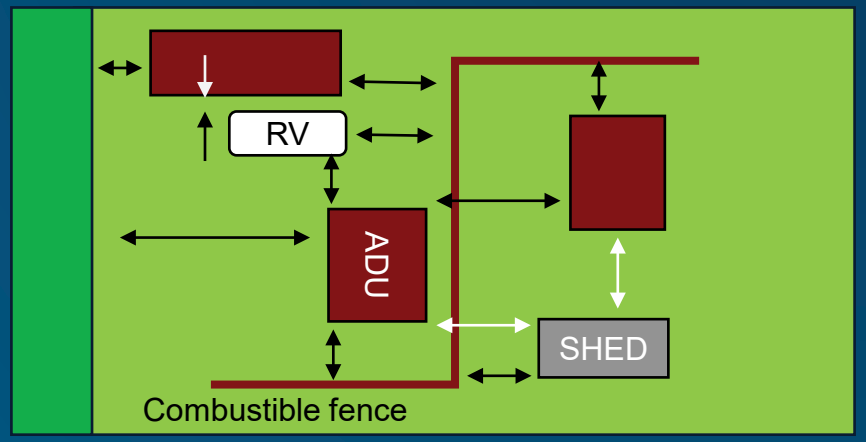
- Greater exposure reduction options:
  - Community design
  - Structure spacing
- Cost effective construction/hardening
- Lifestyle/paradigm shift easier to implement



Parcel Sizes and Hazard Mitigation



NIST TN 2205 (HMM), Figure 14.



"Multiparcel spatial analysis"

Range of Housing Density in Paradise

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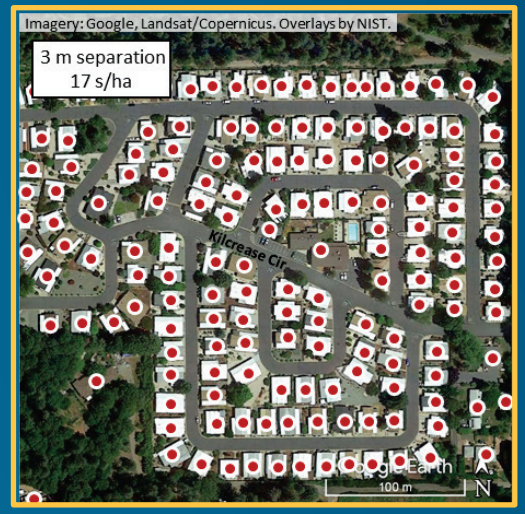
NIST Camp Fire Report #3, Figure 2.

a) Apple Tree Village Mobile Home Park
- ≤ 3 m (10 ft) separation
- 7 structures / acre



b) Lancaster Dr (Bille Rd)
- 3 m (10 ft) separation
- 2.9 structures / acre

c) Valley Ridge Dr
- 8 m (26 ft) separation
- 1.4 structures / acre

d) Round Valley Ranch Rd
- 25 m (82 ft) separation
- 0.3 structures / acre

Partial Structure Hardening

Impacts of Structure Mitigation Compliance on Structure Resilience

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- *Resident has limited control on fire exposures from outside their parcel*
- *Resident has significant control on exposures **within** their parcel: Fuels Reduction, Relocation, Removal and Structure Hardening options*

Effectiveness of partial hardening is *inversely* proportional to local ***fire*** and *ember exposures*, *incident size*, and *number of simultaneous incidents*.

Availability of Defensive Actions

- *Homeowner has limited control on ember exposures*
- *Must harden to protect against embers*

Partial Community Hardening

Impacts of Community Mitigation Compliance on Community Resilience

The impact of a partially hardened structure on the community is proportional to the inverse of SSD

High Structure Density (Low SSD)
One Structure Ignition ⇨ Large Losses

Moderate Structure Density (Moderate SSD)
One Structure Ignition ⇨ Variable Losses

Low Structure Density (High SSD)
One Structure Ignition ⇨ Limited Additional Losses

Partially hardened structures need to be further apart to prevent cascading losses

Effect of Housing Density on Mitigation Approach

		Resident Participation and Complete Structure and Parcel Hardening
High Structure Density (Low SSD) One Structure Ignition ⇨ Large Losses	⇨	*"Required"*
Moderate Structure Density (Moderate SSD) One Structure Ignition ⇨ Variable Losses	⇨	*"Desired"*
Low Structure Density (High SSD) One Structure Ignition ⇨ Limited Additional Losses	⇨	*"Desired"*