Presentation on WUI Fires – Data Collection and Case Studies

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Colorado Springs Fire Department,
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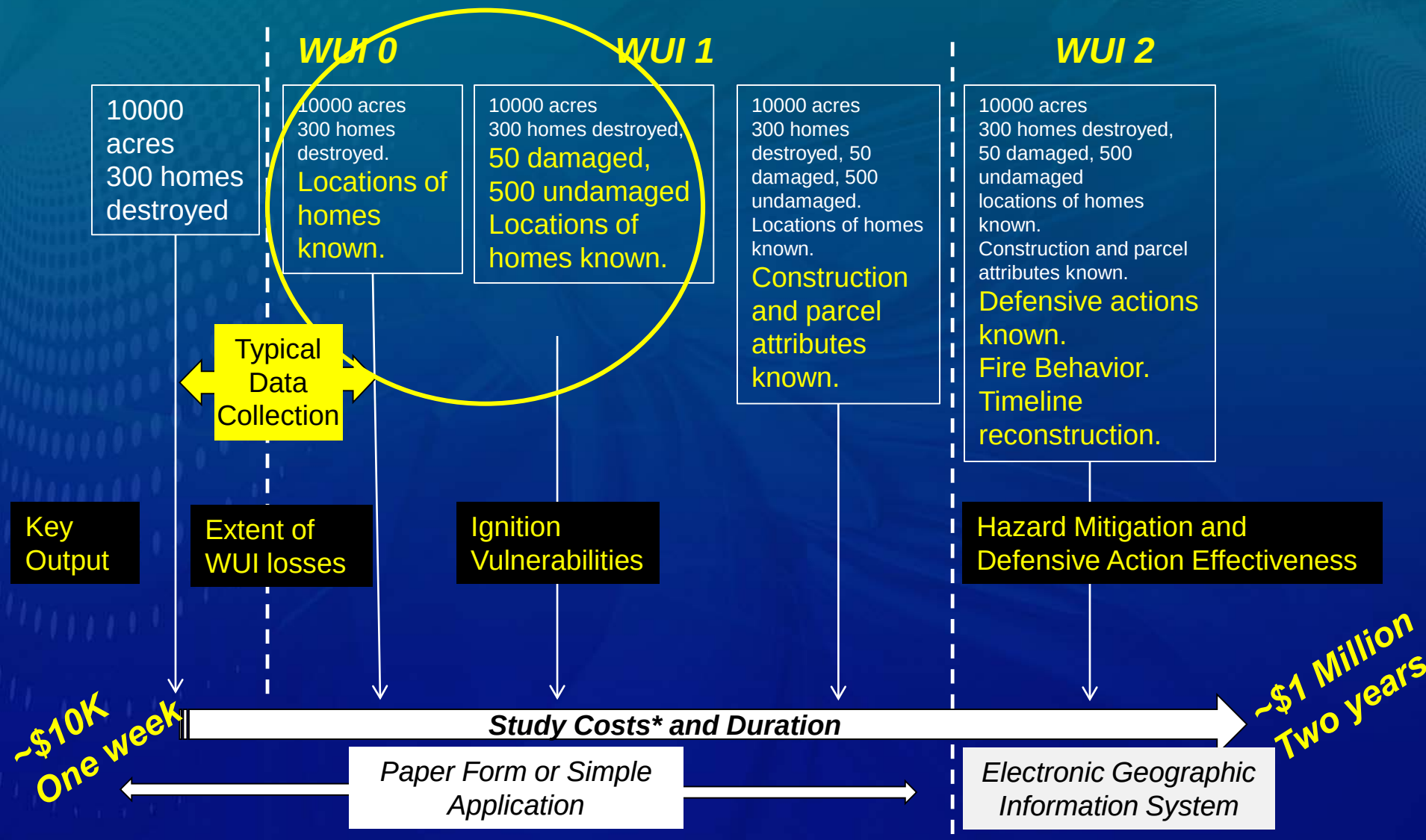
WUI Data

- What type of data is being collected?
- By whom (with what training) and to what purpose?
- How much is being recorded nationally (what is lost)?

WUI Data Collection Continuum



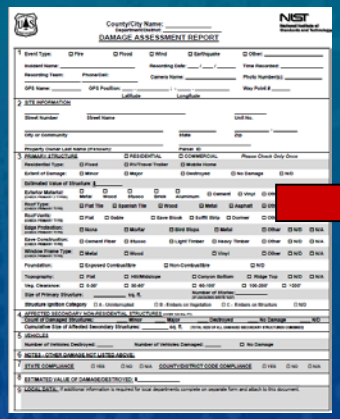
* Listed costs do not include maintenance and improvements of data collection systems

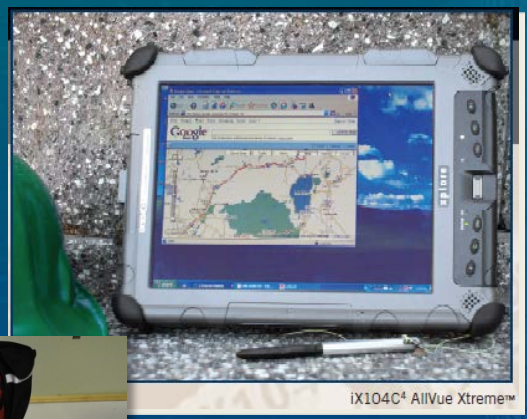
Post-WUI Fire Data Collection and Analysis

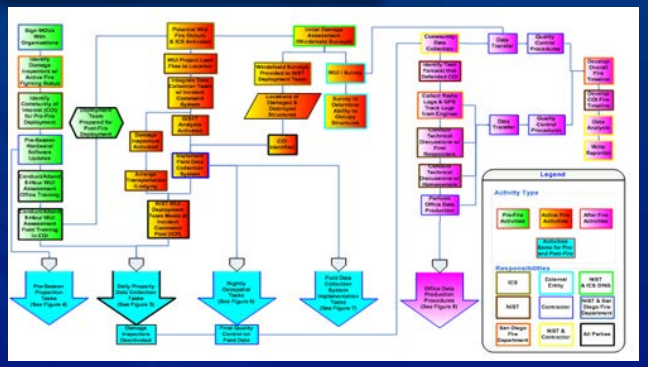
	Sample Population	Destroyed Structures with Wood Shake Roofs	Destroyed Structures with Spanish Tile Roofs	Typical Comparisons	
Typical (only destroyed homes)	74	12	37	**16% of destroyed** homes had wood shake roofs	**50% of destroyed** homes has Spanish tile roofs
Complete (all structures within fire line)	275	12	154		
Technically Valid Comparisons		**100% of exposed** wood shake roofs were destroyed	**24% of exposed** Spanish tile roofs were destroyed		

From NIST Witch/Guejito Report #2

WUI 1 and WUI 2







Quality Assurance Project Plan

WUI 1, *FLOOD 1, WIND 1*

WUI 2

Data Collectors - *Mandate and Training*

- Local - First Responders
- State – First Responders
- Federal – First Responders and Data Specialists (Incident level and Research)
- Private – Various (e.g.: insurance, small business bureau)
- NGO – Various (e.g.: Red Cross)

National Level Recording

- National Interagency Fire Center (Boise Idaho)
  - only incidents with Federal Involvement
- National Fire Incident Reporting System (USFA)
  - volunteer contribution
  - not incident centric but developed as a structure centric system for building fires
- NIST Disaster Repository
  - Future System

NIST Case Studies

Technical and Fiscal Partners

- Primary Technical: Local, State and Federal First Responders, USFS, USGS, NOAA, Academia

- Primary Fiscal: USFS, DHS, Joint Fire Science Program (USFS/BLM)

Event Reconstruction

- Pre-fire LiDAR
- Post-fire imagery
- Digital elevation map (DEM)
- Weather data
- Building construction attributes (pre and post)
  Pre-fire imagery
- Timeline reconstruction

Timeline Reconstruction

- Technical discussions with first responders and residents
- Images and video during the fire
- Radio Logs
- Automatic Vehicle Location (AVL) systems

WUI Fire Event Timeline

Data

Pre-Fire Data

Post-Fire Field Data

Critical data collection time

Timeline Reconstruction

Residents

Resident Evacuation

Residents Return

Time

Fire

Defensive Actions

Fire Ignition

Fire Suppression

Mop-up

Fire Contained

Resources on scene

Time

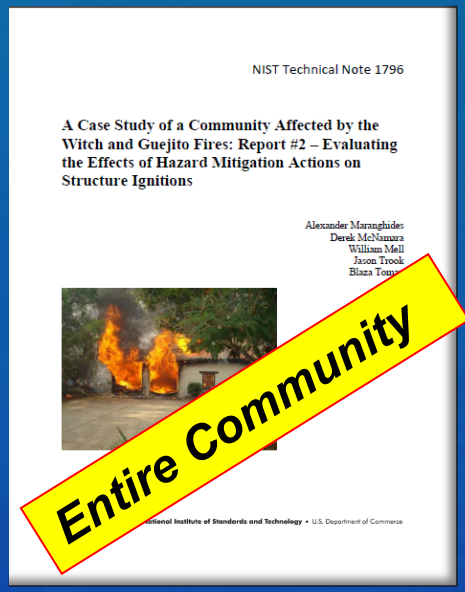
Defensive Actions

Published Case Studies

NIST TN1635 (Witch #1)

- Timeline reconstruction
- Structure Ignitions
- Defensive Actions
- ***Methodology for future developments***

NIST TN1796 (Witch #2)



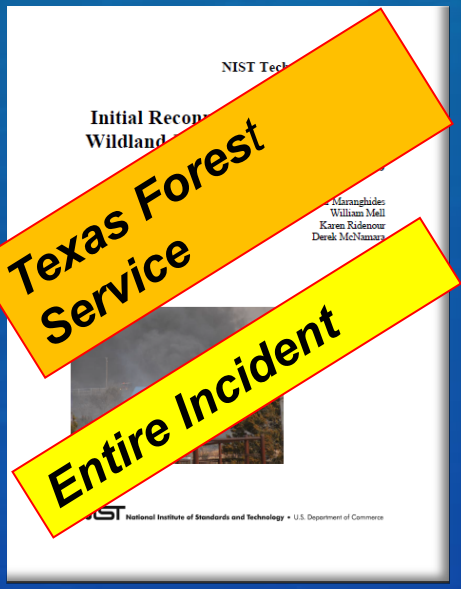
- Exposure quantification!!!

WUI EXPOSURE SCALE

NIST TN-1748

- Defensive Actions
- Effectiveness of Mitigation

NIST TN1708 (Amarillo #1)



- Deployment methodologies
- Damage Assessment Summary

Ongoing Reports

Waldo reports in progress.
ALL Waldo data is DRAFT

AMARILLO #2

Report In Review

Entire Incident

- Fire Behavior
- "Area/Neighborhood" Case Studies

WALDO #1

Colorado Springs FD

Entire Incident

- Timeline reconstruction
- **Defensive Actions**
- Fire Behavior

WALDO #2

Entire Incident

- Exposure quantification
- "Area/Neighborhood" Case Studies

Witch/Guejito Fire

- The case study is focused on The Trails development at Rancho Bernardo, north of the City of San Diego.
- There were 274 homes in The Trails, with 245 within the fire perimeter
- 2 Fatalities
- 74 homes were completely destroyed and 16 were partly damaged.
- Field measurements included structure particulars, specifically roof type, proximity of combustibles to the structure, and damage to wildland and residential vegetation.
- Documentation included over 11 000 pictures.
- The field data collection effort took approximately 1300 person hours over 14 months.

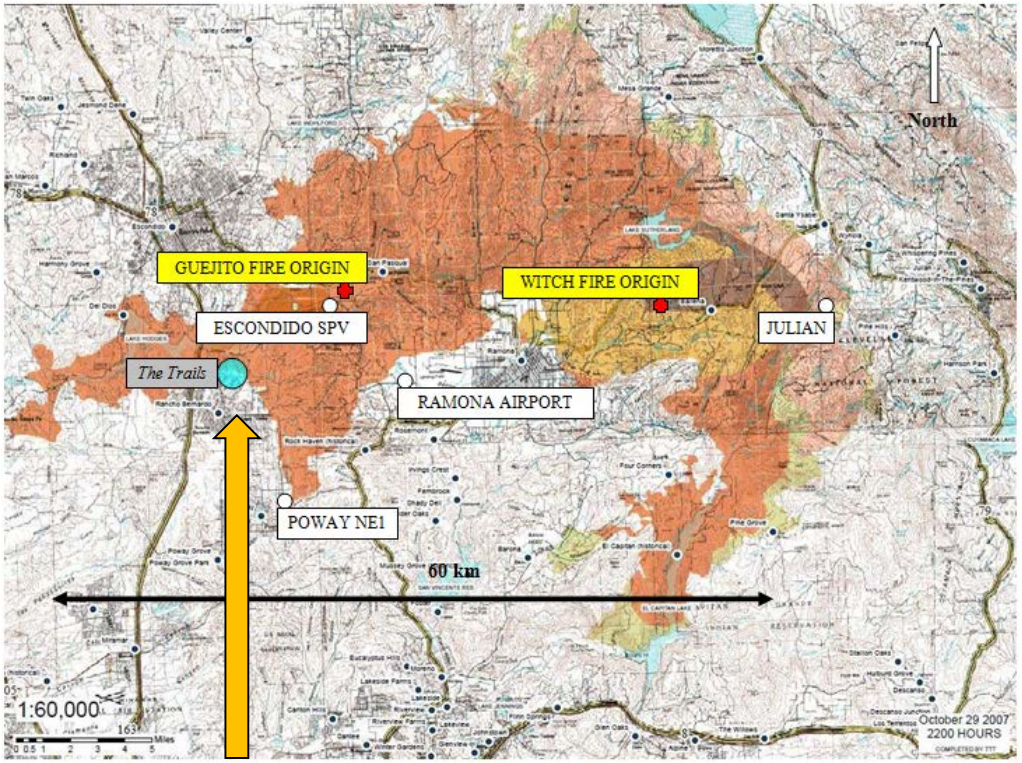
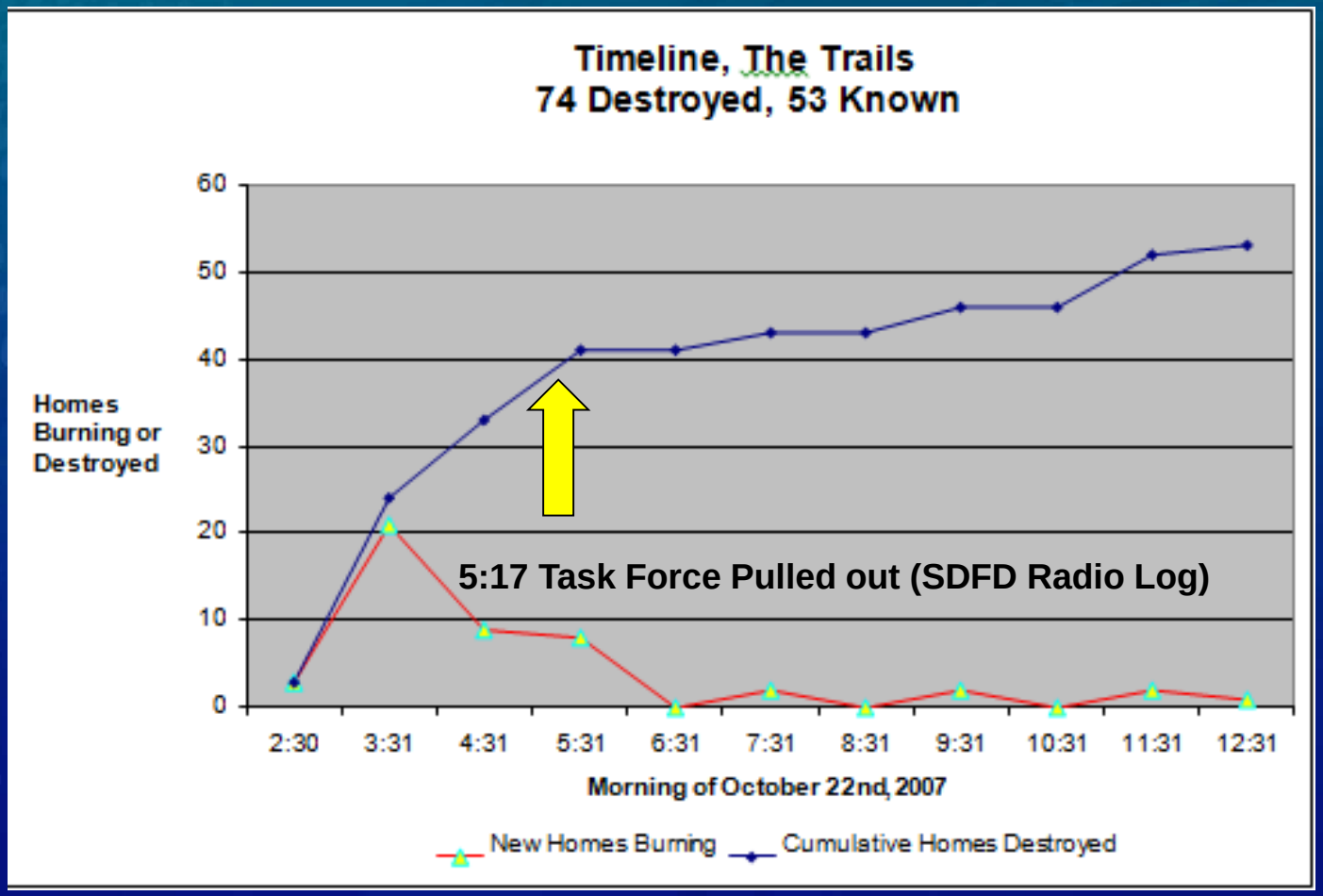


Figure 4: Origins of the Guejito and Witch Creek Fires, the combined perimeter of both fires and the locations of the weather stations used later in the report. (map Courtesy of CALFIRE)

CASE STUDY OF THE TRAILS COMMUNITY

Witch/Guejito - Timeline



Witch/Guejito – Structures Defended ("no-one there…")

- 1/3 of all structures defended

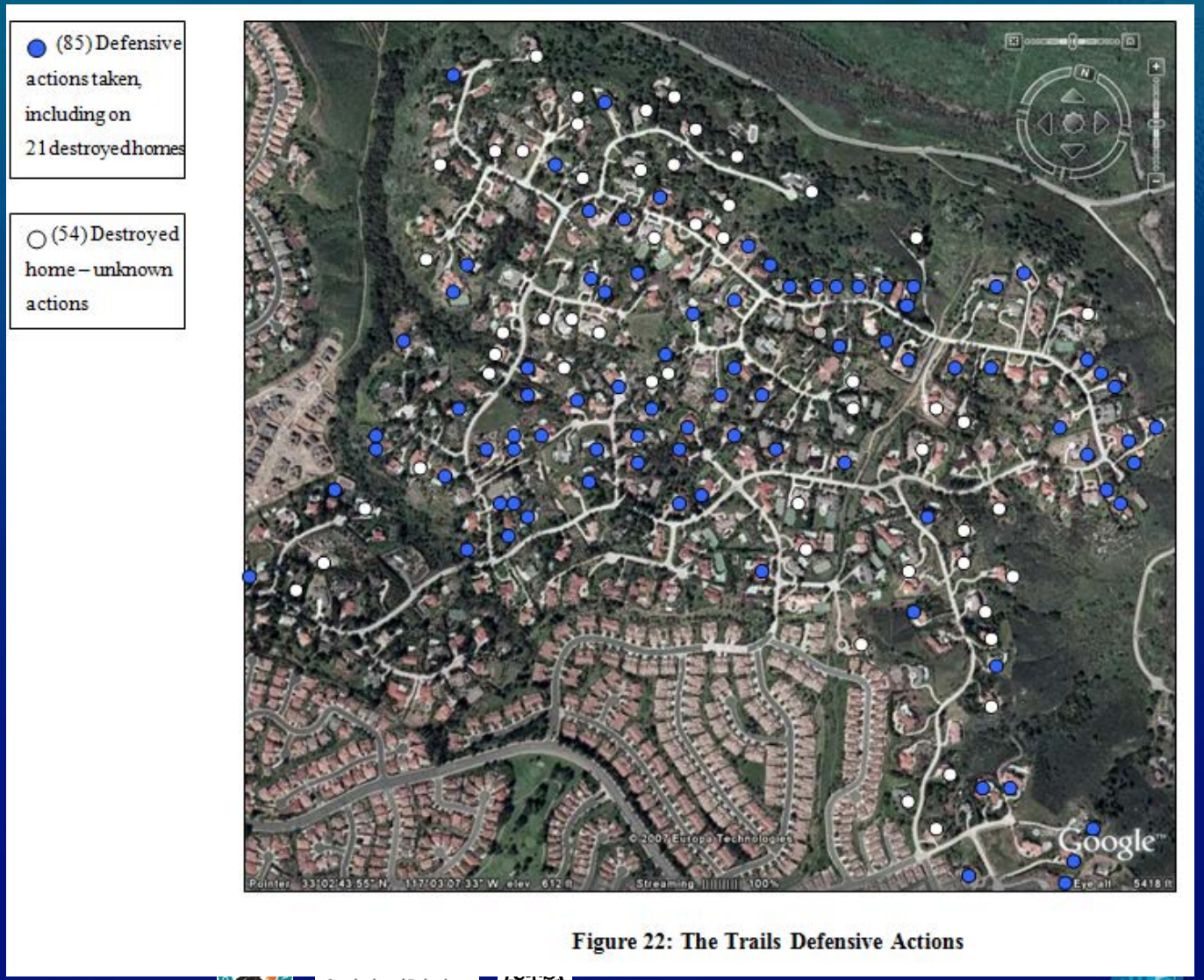


Figure 22: The Trails Defensive Actions

Witch/Guejito – Fire Progression

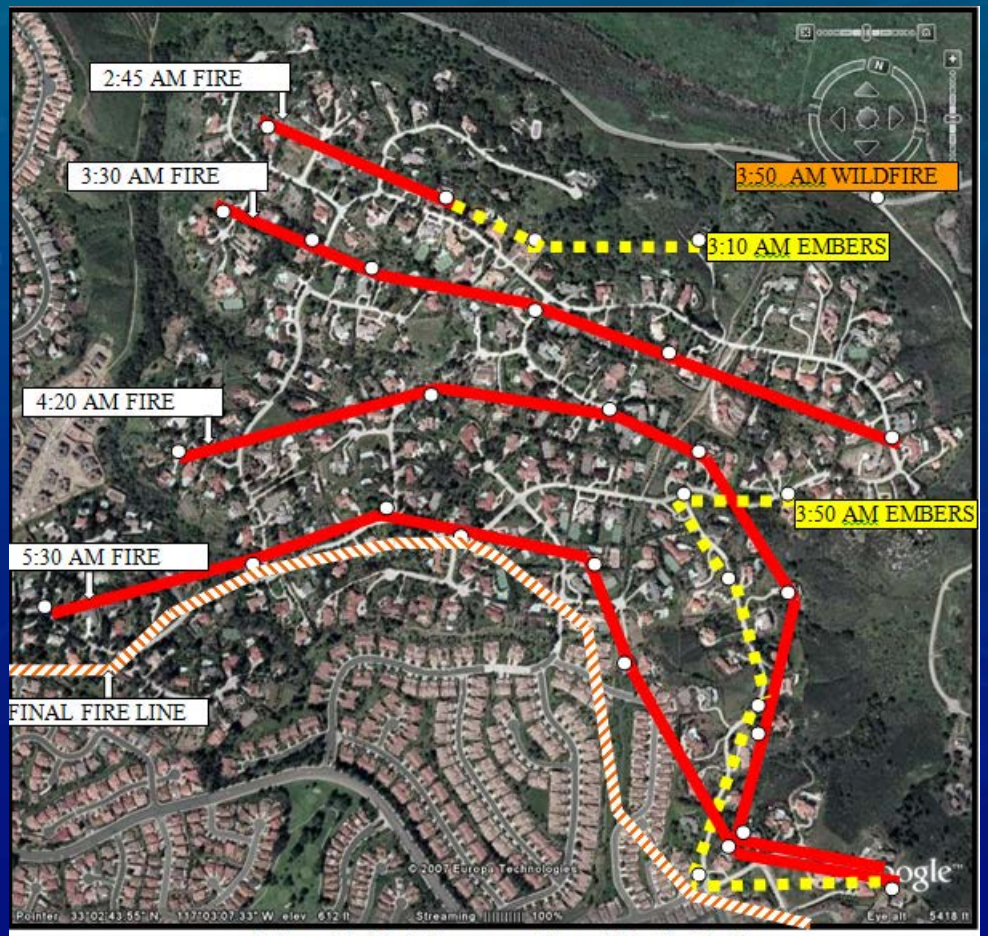


Figure 20: Fire Line progression within The Trails

Witch/Guejito – Effectiveness of Defensive Actions

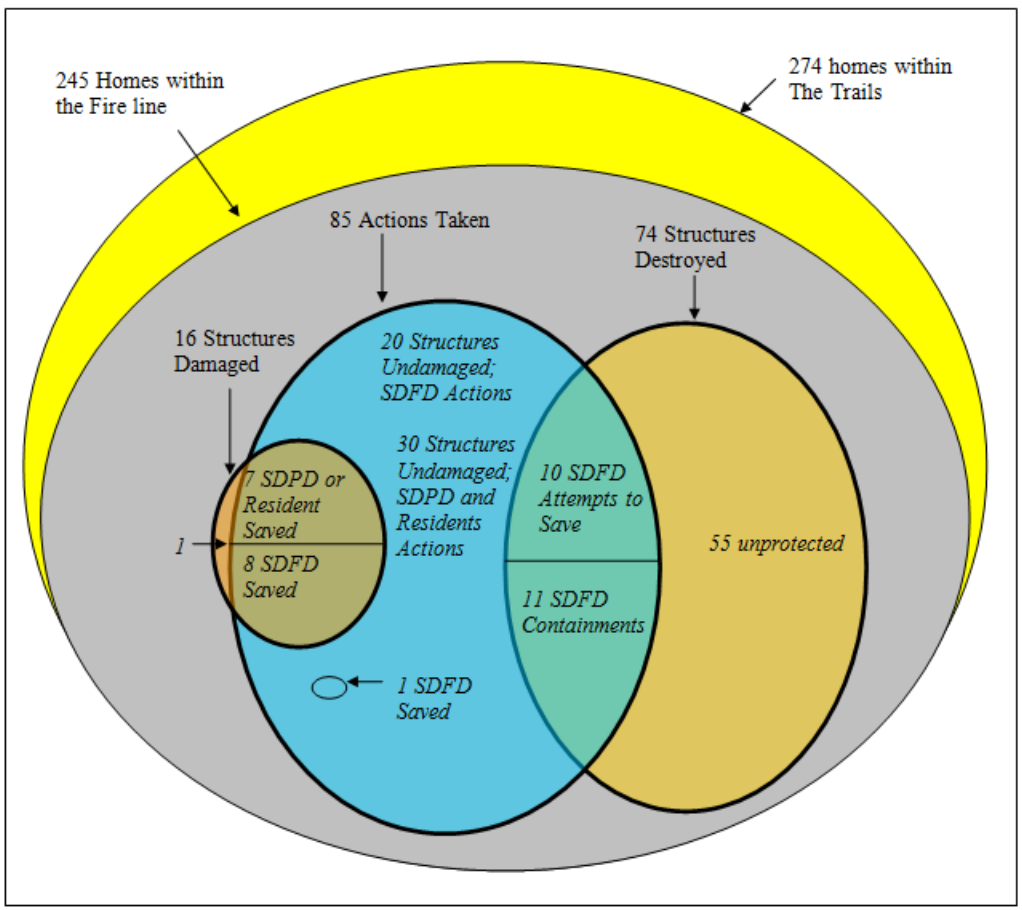
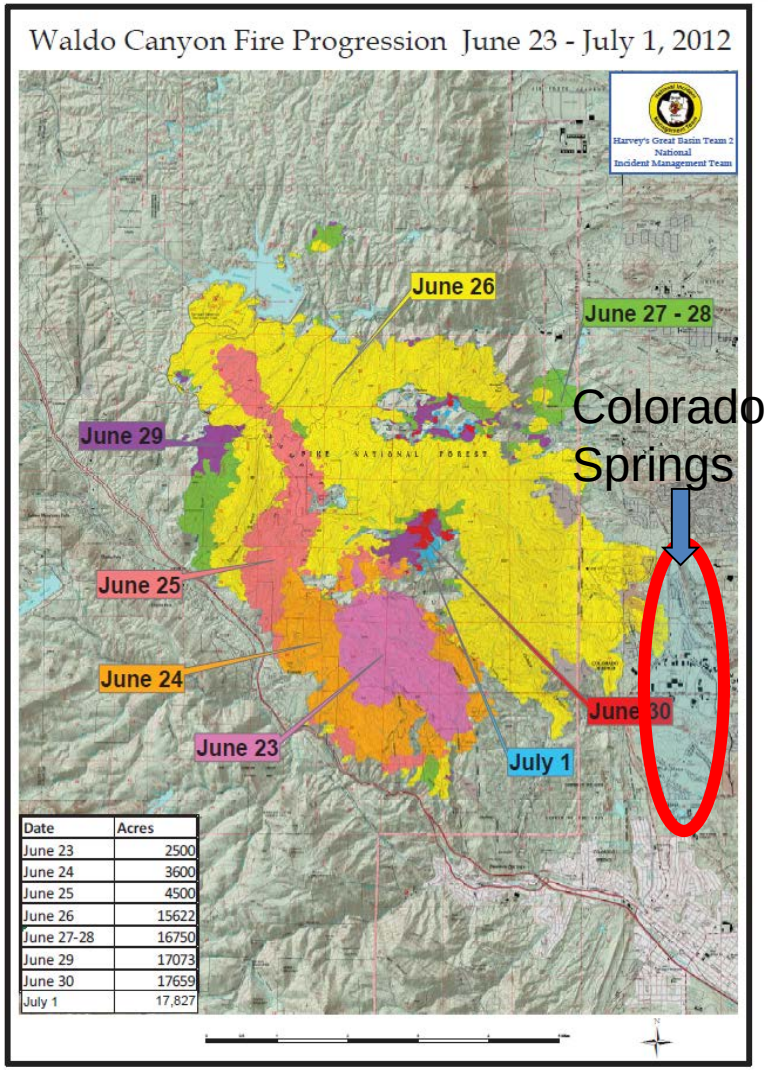


Figure 23: Impacts of the Defensive Actions Taken at The Trails

NIST TN1796 (Witch #2) documented the effectiveness as a function of exposure

Waldo Canyon Fire, CO

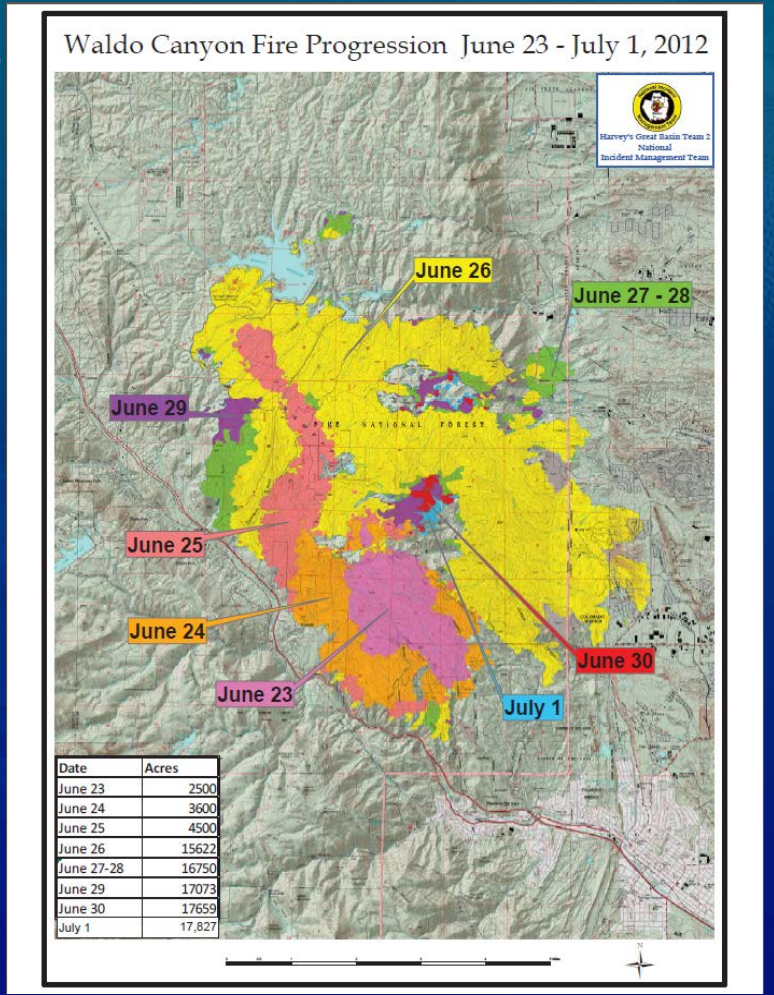
- The fire was active in the Pike National Forest and adjoining areas
- 18,247 acres (29 sq mi; 74 km^2) burned
- 2 Civilian fatalities during the fire, additional fatalities from ongoing flooding
- 346 homes were destroyed in Colorado Springs. 1,000 homes within the fire line
- The Waldo Canyon Fire resulted in insurance claims totaling about $0.5 Billion – number keeps increasing due to associated flooding after the fire
- 30,000 evacuated



CASE STUDY OF ENTIRE FIRE

Waldo Canyon Fire Case Study

- JFSP, NIST, USFS, NOAA, NGIA, USGS, Colorado Springs Fire Department and numerous State and Local Jurisdictions
- 3rd Case Study
- 346 Homes Destroyed
- 1000 Homes within Fire Line
- 3500 Hours data collection effort to date. Data collection 95% completed.
- Detailed timeline emerging
- Defensive actions – essential to interpreting post fire data
- Over 4,500 distinct fire observations and/or defensive actions spanning ~8 hours of incident



Waldo Fire and Colorado Springs

- Three Communities Affected
  - **Cedar Heights (zero structures lost)**
  - **Mountain Shadows (346 residences lost)**
  - **Peregrine (zero structures lost)**

Summary

- Extensive (WUI 2) WUI Fire Incident Data Collection is a critical component of the NIST WUI Hazard Mitigation Research Approach
- In depth case studies provide critical insight into:
  - Hazard mitigation failures
  - Built environment vulnerabilities
  - First responder effectiveness

Future Activities

Near Term – next 3 years

- Quantifying the scale of the WUI fire problem:
  - Improve WUI data collection - with selected states
  - Investigate historical WUI data – with selected states
- Test identified building vulnerabilities and start improving them

Intermediate Term – 3+ years

- Respond to WUI *intermix* and interface fires
- Improve building Codes/Standards and Test Methods

Extra Waldo Case Study Materials

Mountain Shadows Summary

- The Waldo Fire reached Mountain Shadows Tuesday, June 26th in the afternoon. Three hundred and forty-six homes were destroyed as a result of the Waldo fire.

engineering laboratory

Observations - Structures

- Structure not on fire
- Structure on fire
- *Structure ignition roof*
- *Structure ignition eaves*
- Structure ignition flame impingemer
- Structure ignition garage
- Structure ignition other
- *Structure ignition deck*
- *Deck on fire*
- Roof on fire
- Structure standing fire extinguished
- *Structure standing fully involved*
- *Structure past peak*
- *Structure foundation*
- No defensive action
- Prior defensive action

DRAFT

Observations – Parcels and Detached Combustibles

- Parcel not on fire (veg)
- Parcel ignition (veg)
- Parcel ignition (detached comb
- Parcel on fire (veg)
- Detached combusti ire
- Detached combustib s not on fire
- Rail Road (RR) ties on fire
- Play sets on fire
- Fences on fire
- Smoking/melting/pre-ignition
- No specific fire observation
- No defensive action
- Prior defensive action

Observations -Exposure incoming or received [1]

- Flame impingement
- Radiant exposure
- Ember exposure from struct
- Ember exposure from
- Ember exposure fro nknown source
- Exposure from adjacent burning structure, type unknown
- Low exposure
- Exposure from adjacent burning detached combustible, type unknown

[1] Quantizing fire and ember exposure in a post fire environment results in significant uncertainties. The data collected here will be used to illustrate fire behavior in high density construction, specifically structure to structure spread. This data should not be used to assess or predict hazard mitigation effectiveness as a function of structure spacing or building construction materials.

Defensive Actions

Defensive Action Objective

- Prevent parcel ignition
- Prevent structure ignition
- Prevent detached combustible ign
- Extinguish parcel
- Extinguish structure
- Extinguish detached c ible
- Contain parcel
- Contain structure
- Pre-positioning of equipment
- Remove fences
- Vegetation removal
- Mop up

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Defensive Action Tools/Tactic Used

- Hand tools
- Garden hose
- Sprinklers
- Fire hose
- Foam
- Deckgun
- Interior (going inside the structure)
- Structure prep
- Back fire
- Dozer line
- Thermal imager
- Water curtain

Cedar Heights Summary

- The primary fire activity reached the community from the west Saturday, June 23rd night into the m[illegible] of Sunday, June 24th. Exposure of structures to fire a[illegible] was limited to low ember exposure on only one struc[illegible] structure, at 3725 Outback Vista, and its surroundi[illegible] actively defended during the ember assault. There we no i[illegible]ted ignitions on the structure or on that parcel. No structures were lost or damaged in this community. Fuel treatments were conducted on the northwest side of the community.

Woolf Ranch to Peregrine Summary

- The Waldo Fire reached the area between Woolf Ranch and Peregrine starting Tuesd[illegible]une 26th in the evening. The neighborh[illegible]tween Woolf Ranch and Peregrine did not ex[illegible]e any structural ignitions and these structures d[illegible]t experience any fire and ember exposure from the wildland fire. Dozer lines were created in several locations to create fuel discontinuities