Home Destruction During Extreme Wildfire Conditions

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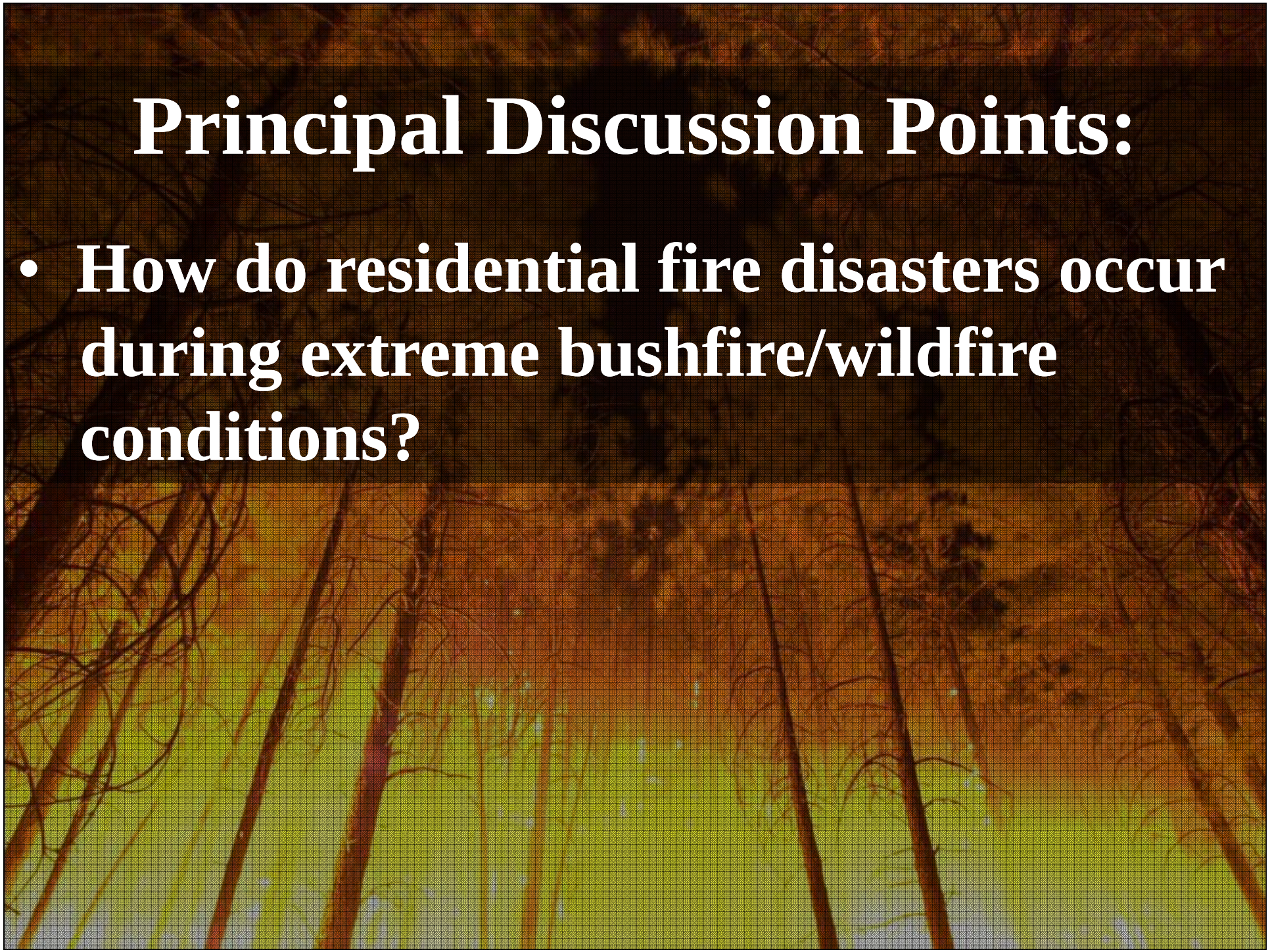
Cedar Fire
San Diego, CA 2003

Principal Discussion Points:

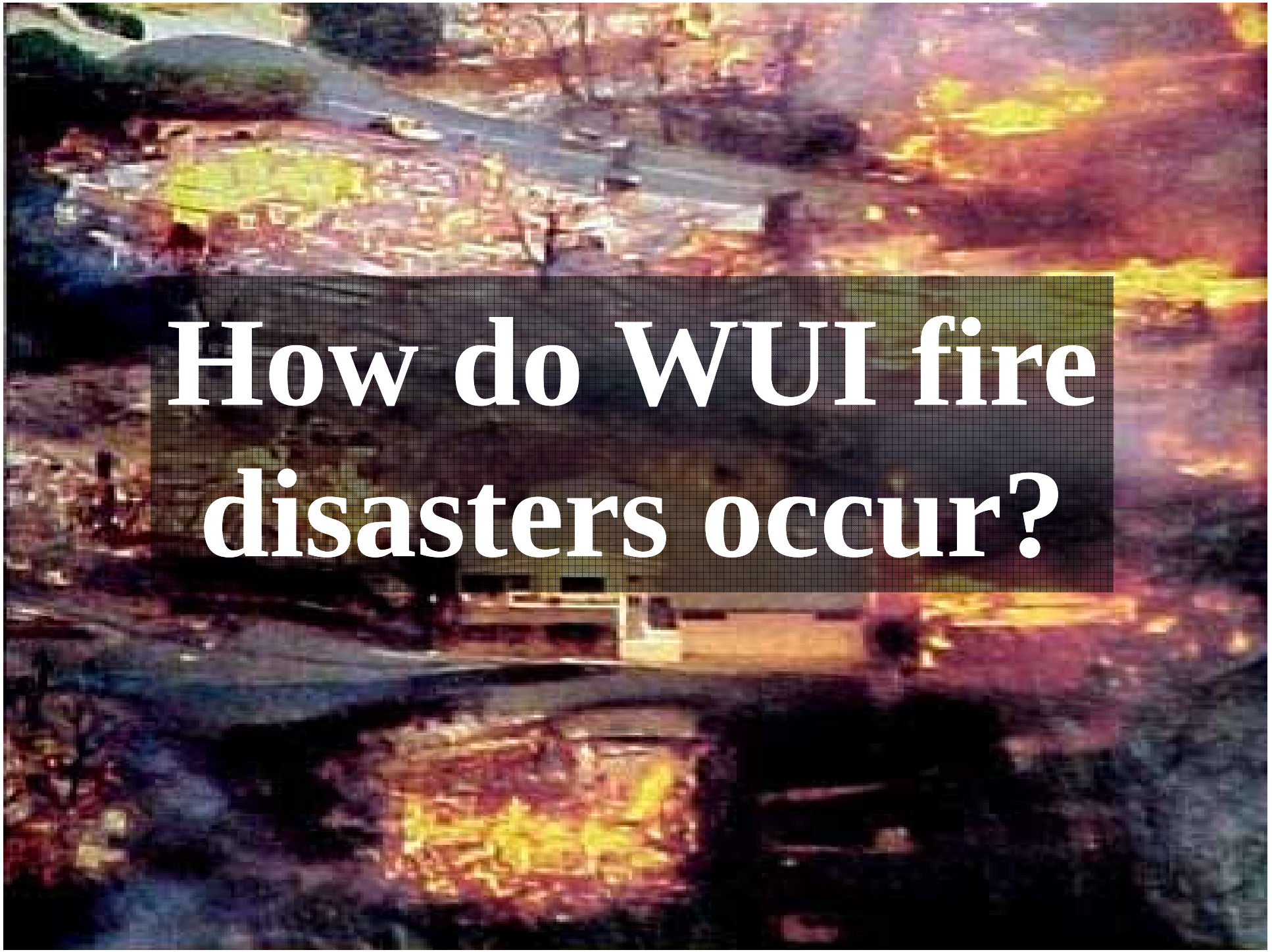
- **How do residential fire disasters occur during extreme bushfire/wildfire conditions?**



Principal Discussion Points:

- **How do residential fire disasters occur during extreme bushfire/wildfire conditions?**
- **What opportunities do we have for preventing wildland/bushfire-interface (WUI) fire disasters?**


Disastrous Residential
Fire Destruction


How do WUI fire disasters occur?

How do wildland-urban fire disasters occur?

Extreme fire conditions → **Wildland fire** → **Urban fire** →

(Fuel+wx + topo)

(Rapid spread + high intensity)

(Simultaneous home ignitions)

Fire protection resources → **Fire Protection** → **Many totally destroyed homes**

(Overwhelmed)

(Reduced effectiveness)

Wildfire suppression and structure protection comprise the primary approach to preventing WUI fire destruction.

How do wildland-urban fire disasters occur?

Extreme fire conditions

(Fuel+wx + topo)

~~Wildfire control~~

Urban fire

(Simultaneous home ignitions)

Fire protection resources

(Overwhelmed)

~~Protection~~

During extreme wildfire behavior if firefighters cannot respond to homes then fire protection doesn't occur and the technology and logistics that support firefighters are not effective.

And, if no one is present to extinguish home ignitions,

any sustained home ignition results in total destruction –

whether it happens in 20 mins or 12 hrs.

Tactical success…


Strategic failure!

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If homes don't ignite, homes don't burn!

And, if homes don't burn, the WUI fire problem does not exist.

This suggests a WUI fire approach principally in terms of home ignition potential rather than bushfire/wildfire suppression and structure protection.

Opportunity for Preventing WUI Fire Destruction

Opportunity for Preventing WUI Fire Destruction

A Home Ignition Approach


Define the wildfire/bushfire residential fire destruction in terms of how homes ignite.

Defining WUI Fire Destruction as a Home Ignition Problem

In its simplest terms, a wildland-urban fire is where the fuel feeding a wildfire changes from wildland fuel to urban fuel.

For this to happen, wildland fire must be close enough for its flying brands and/or flames to contact the flammable parts of the structure.

Defining WUI Fire Destruction as a Home Ignition Problem

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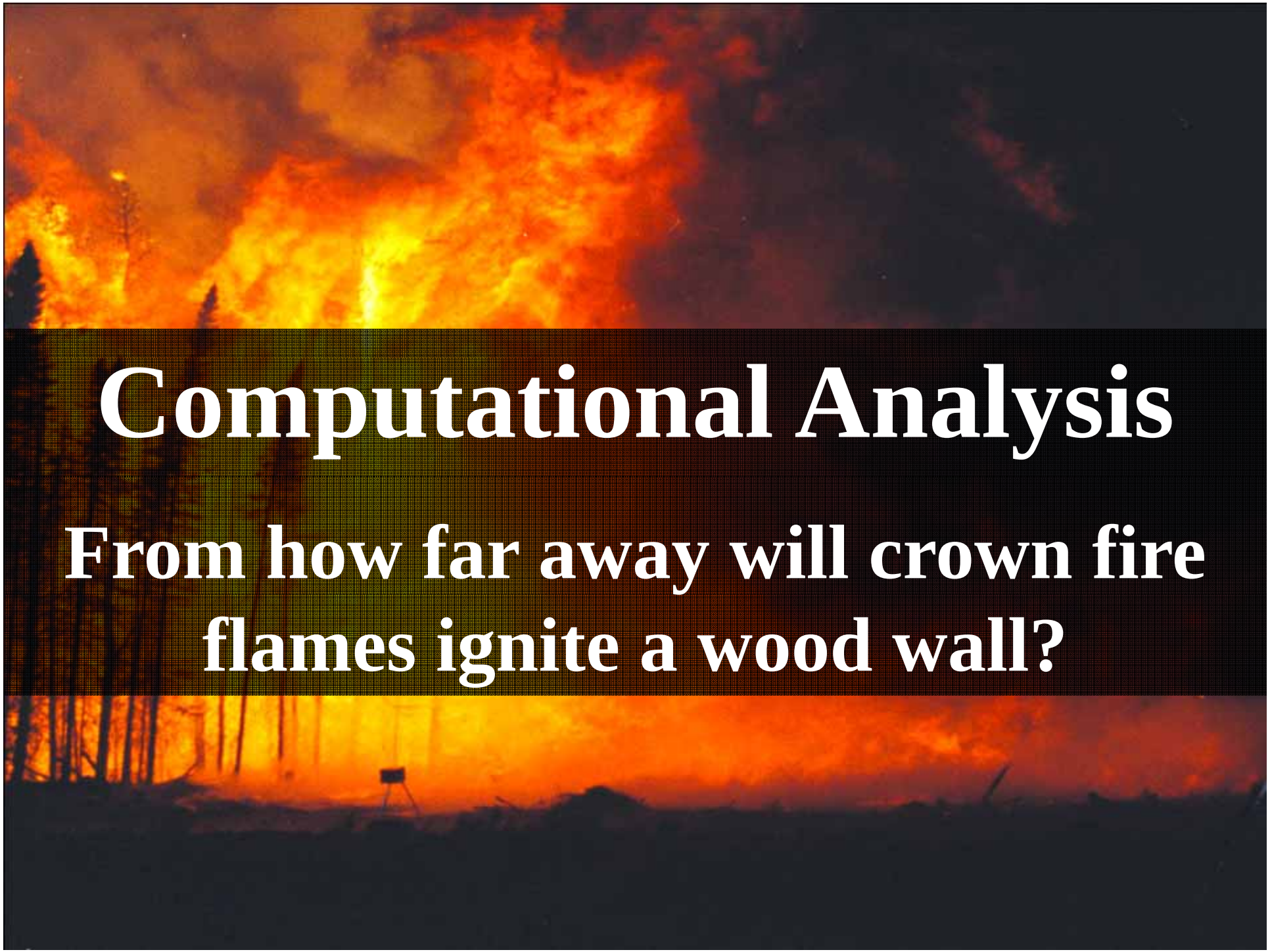
For this to happen, wildland fire must be close enough for its flying brands and/or flames to contact the flammable parts of the structure.

Conceptually defines the relationship between home destruction and the flames and firebrands of extreme wildfire?

Research analyses,

- **Computational analysis,**
- **Crown fire experiments,**
- **WUI fire examinations,**

have provided specific insights on how homes ignite during extreme bushfire/wildfire behavior.



Computational Analysis

From how far away will crown fire flames ignite a wood wall?

Modeling Results

Making model assumptions to over-estimate the distance flame radiation can ignite wood:

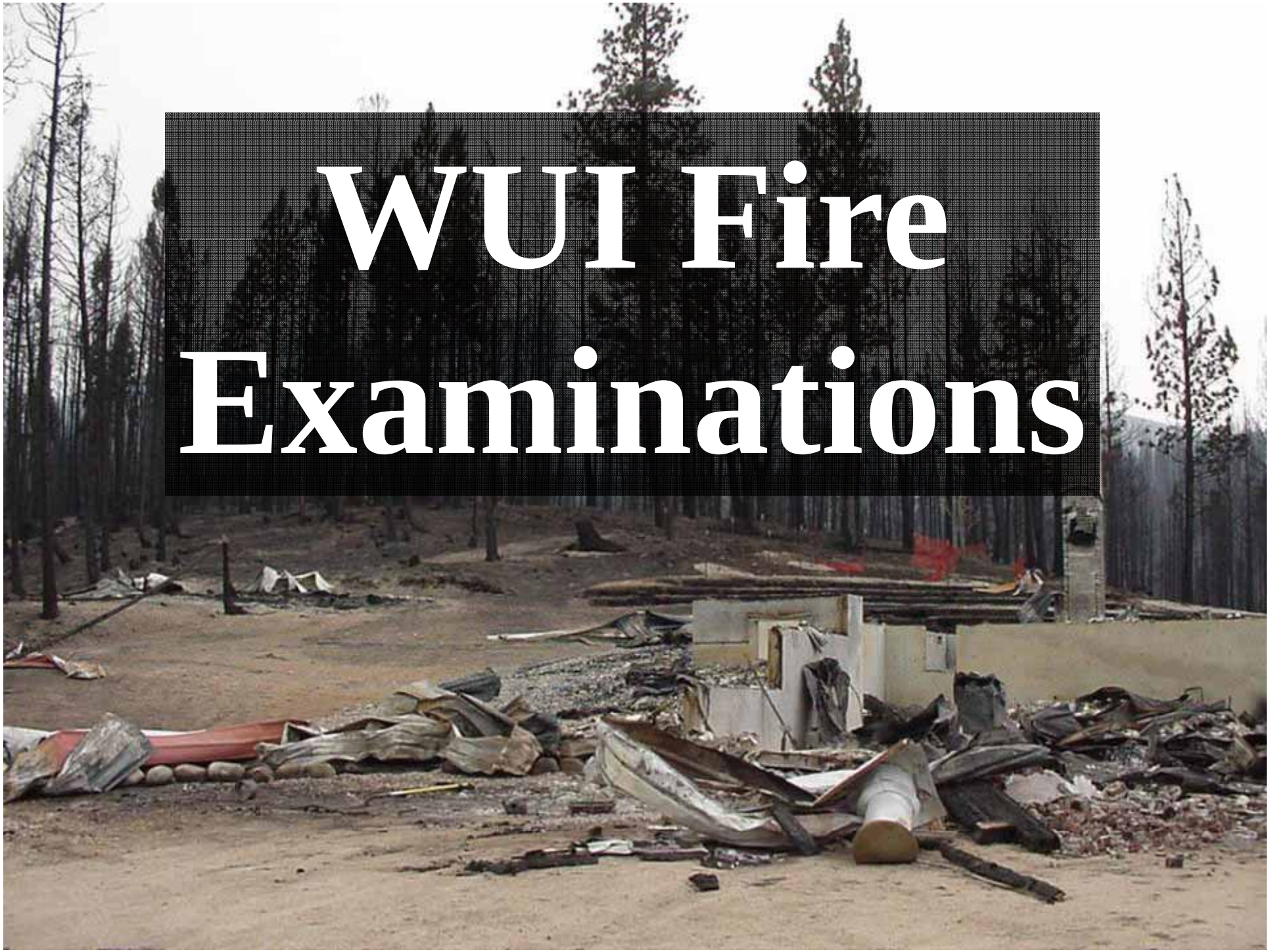
Crown fire flames must be within 30 meters/100 feet before wood wall ignition will occur (radiant heating).

Crown Fire Experiments

Crown Fire Experiments

Significant Results:

- **Validated that the 30 m/100 ft computed distance over-estimated,**
- **Intense crown fire flames burnout at a location in less than 50 secs.**

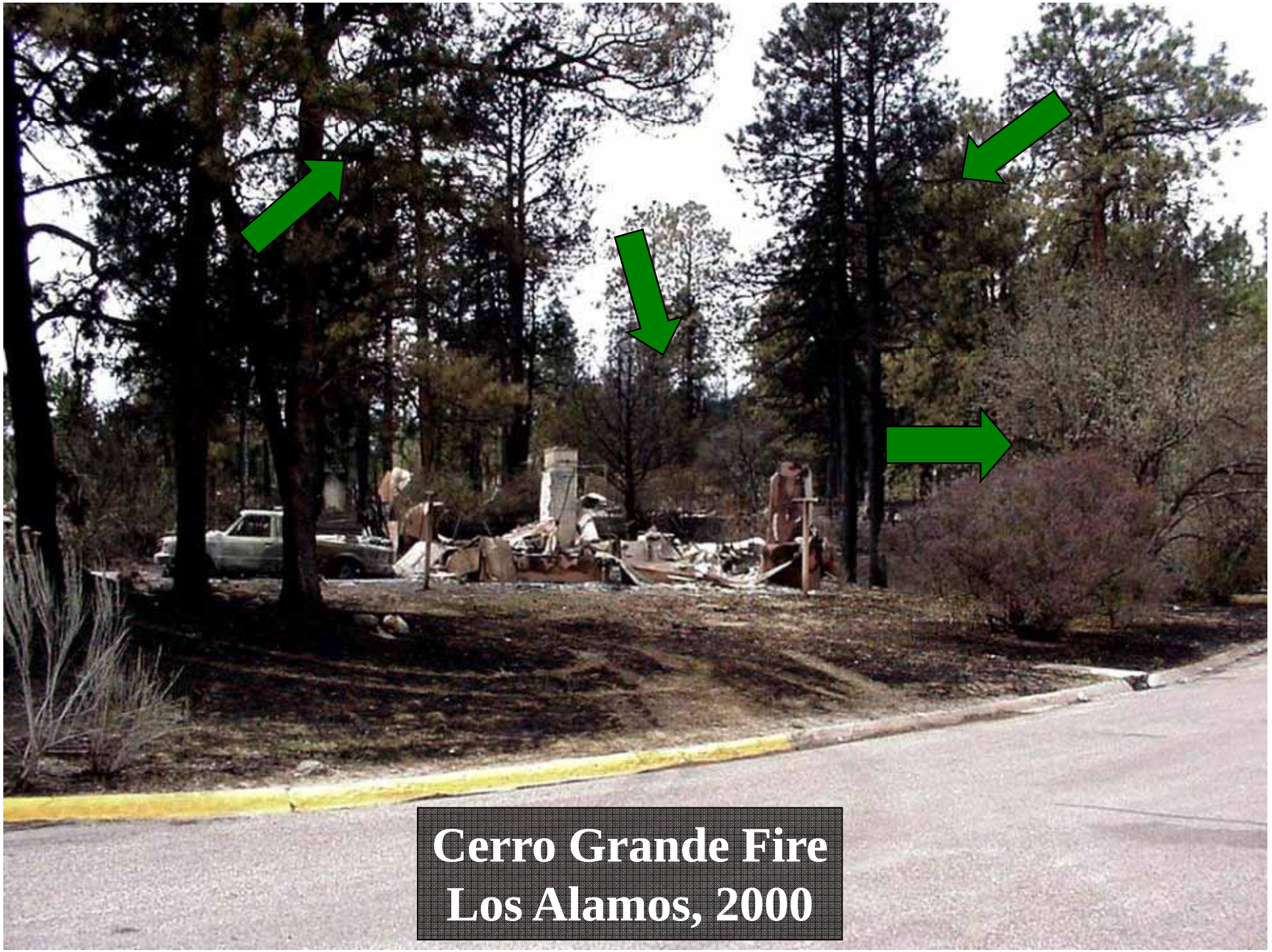


WUI Fire Examinations

Examination findings:

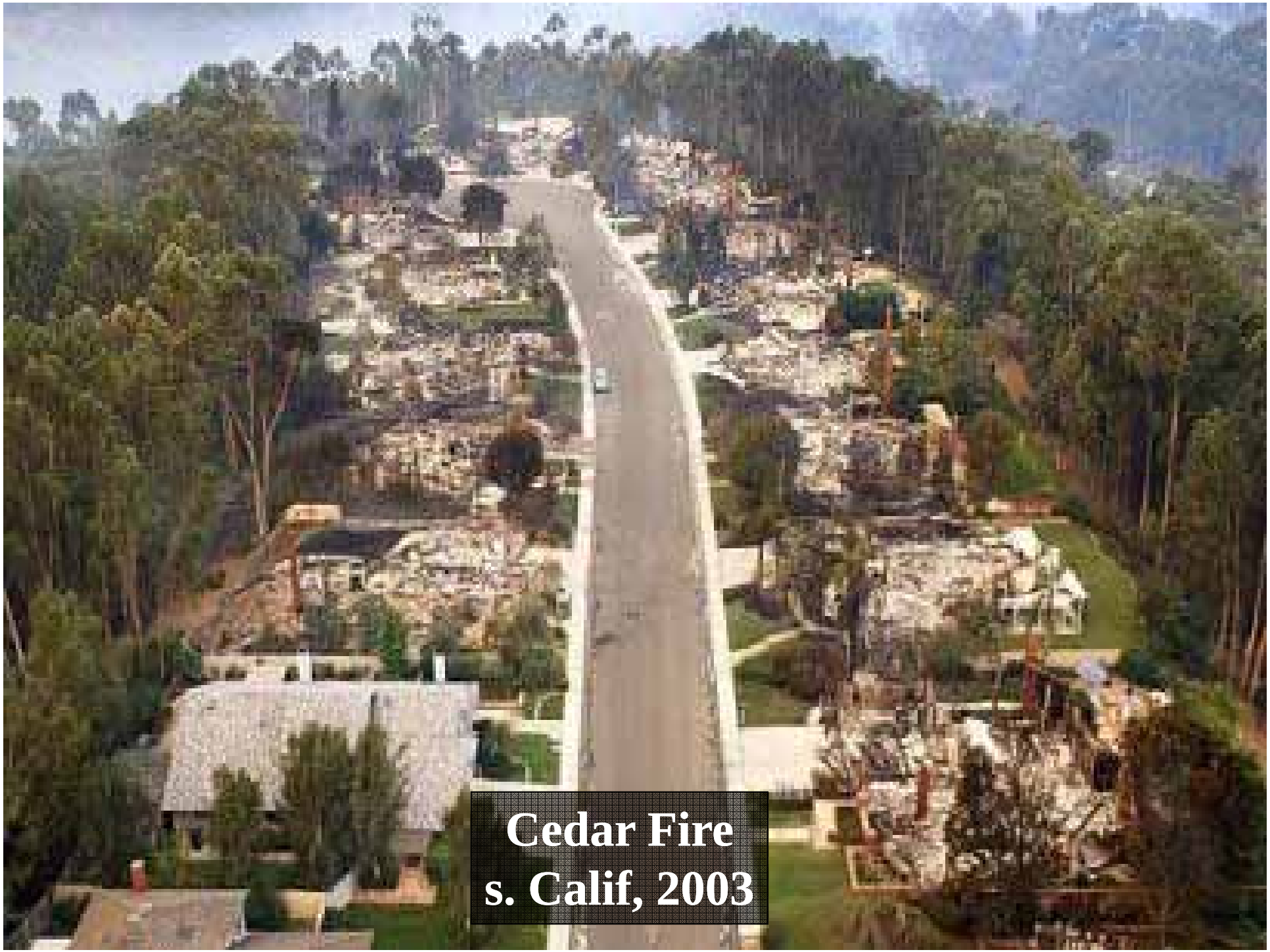
Most destroyed homes with adjacent unconsumed vegetation.

Ignitions occur from lesser intensity sources – surface fire and firebrands.


Cerro Grande Fire
Los Alamos, 2000


Hayman Fire
Colorado, 2002


Grass Valley Fire
s. Calif, 2007


Cedar Fire
s. Calif, 2003

Kinglake, Victoria 2009

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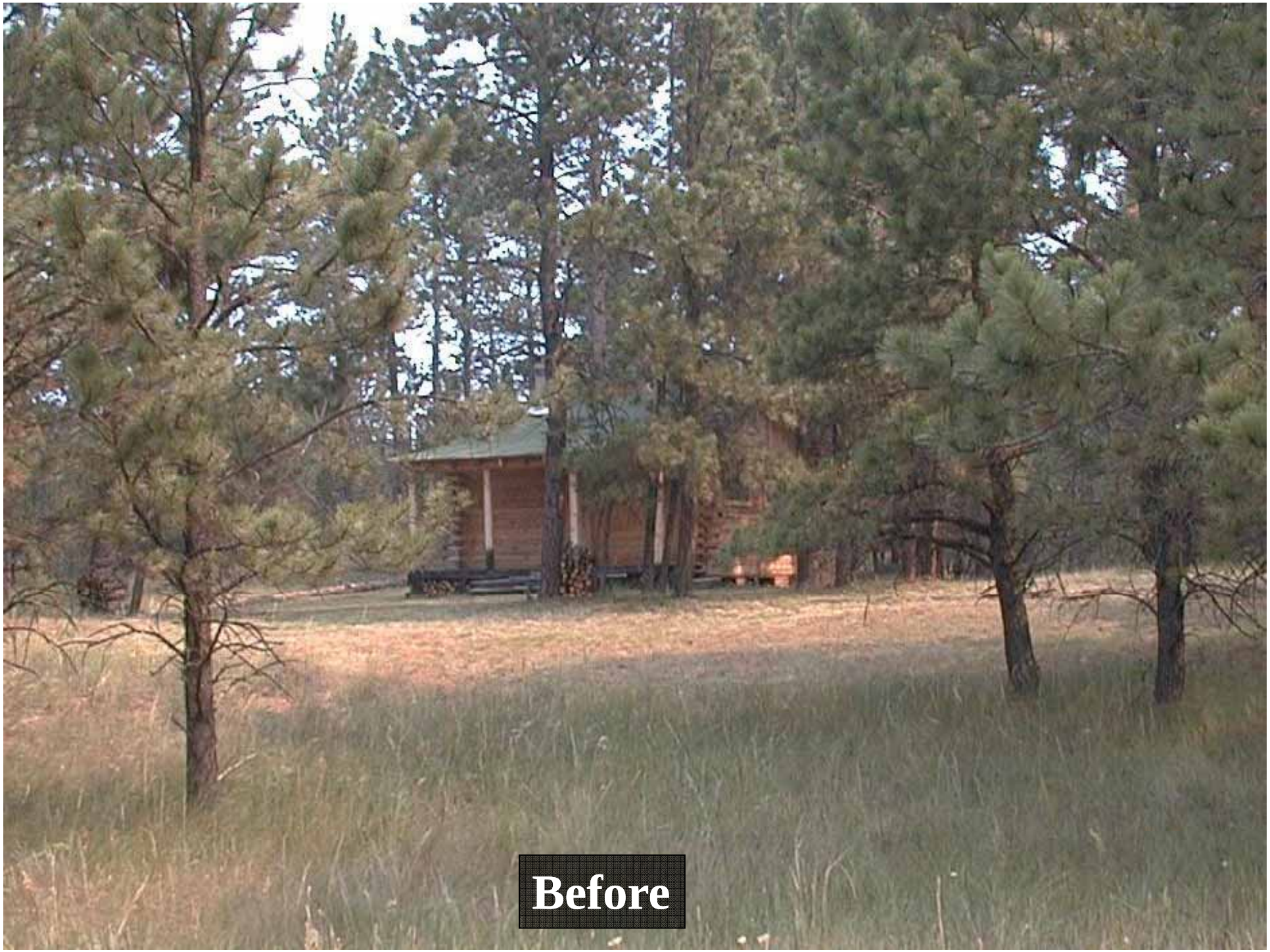
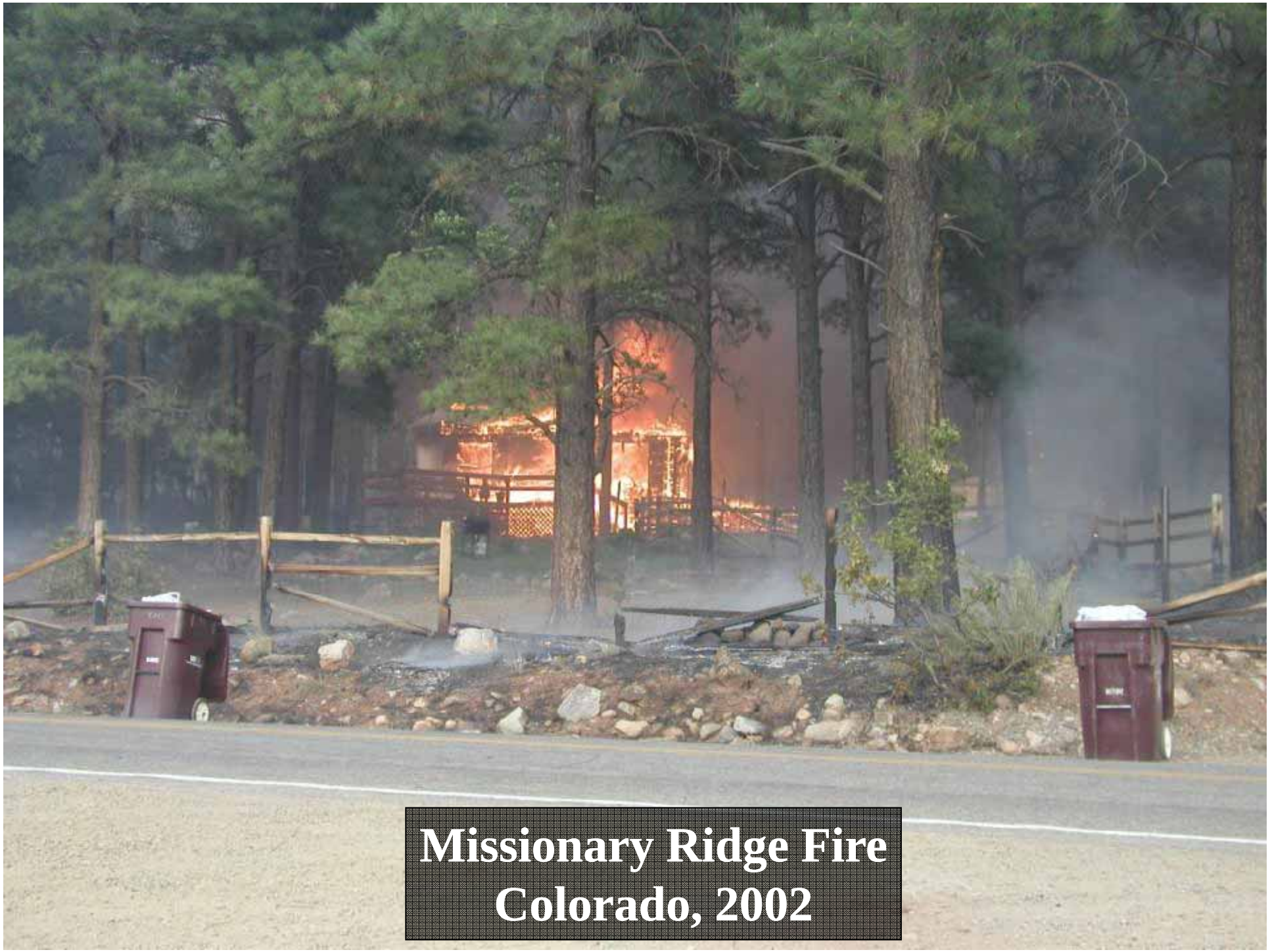
Angora Fire
Lake Tahoe, CA 2007


Before


After
Elk Mtn. Fire
Colorado, 2003


Missionary Ridge Fire
Colorado, 2002

Examination findings:

Homes commonly ignite and burn hours after the wildfire has ceased its extreme fire behavior;

Most homes destroyed are not directly ignited by extreme wildfire behavior.

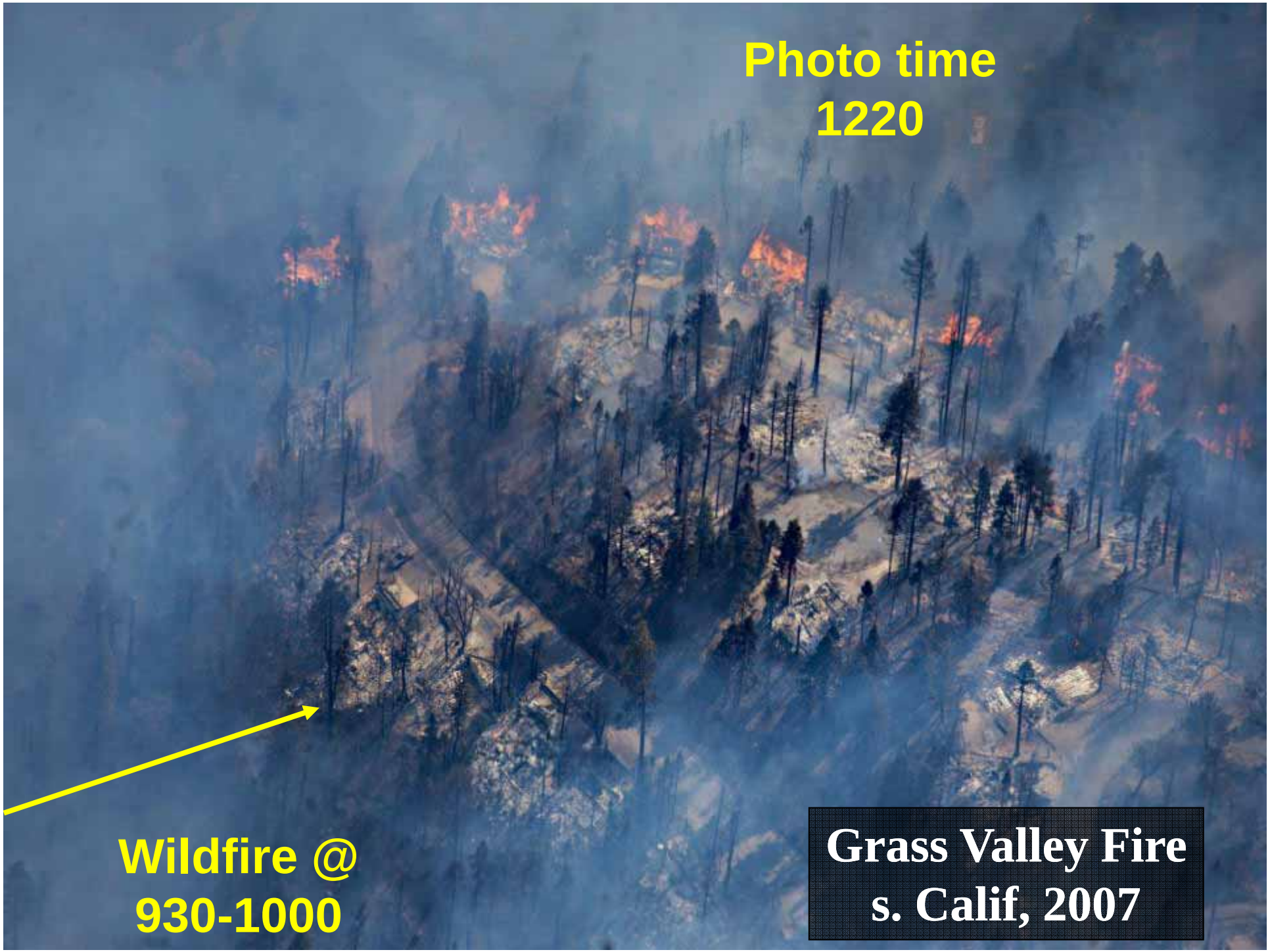


Photo time
1220
Wildfire @
930-1000
Grass Valley Fire
s. Calif, 2007

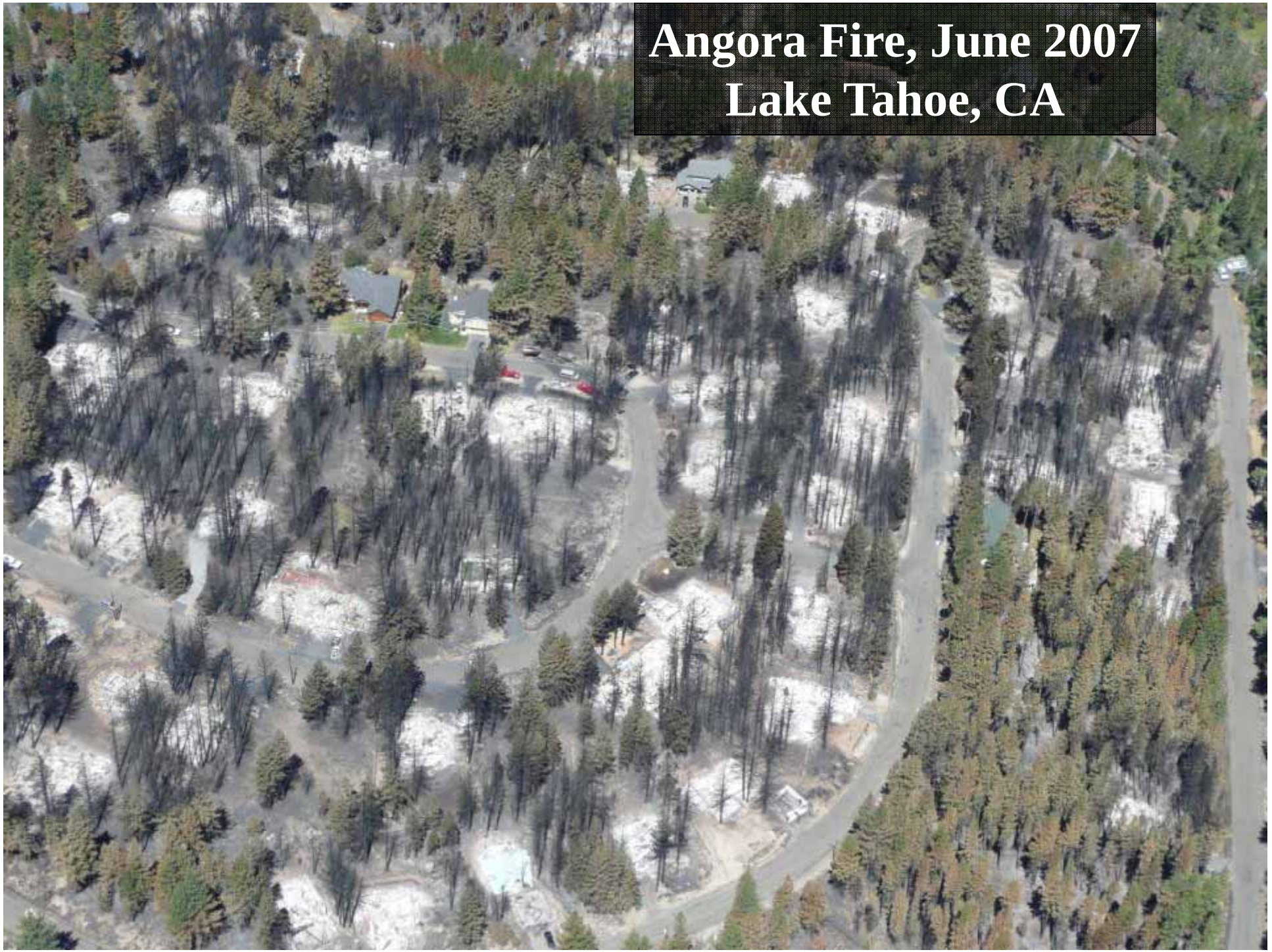

Photo time
1220

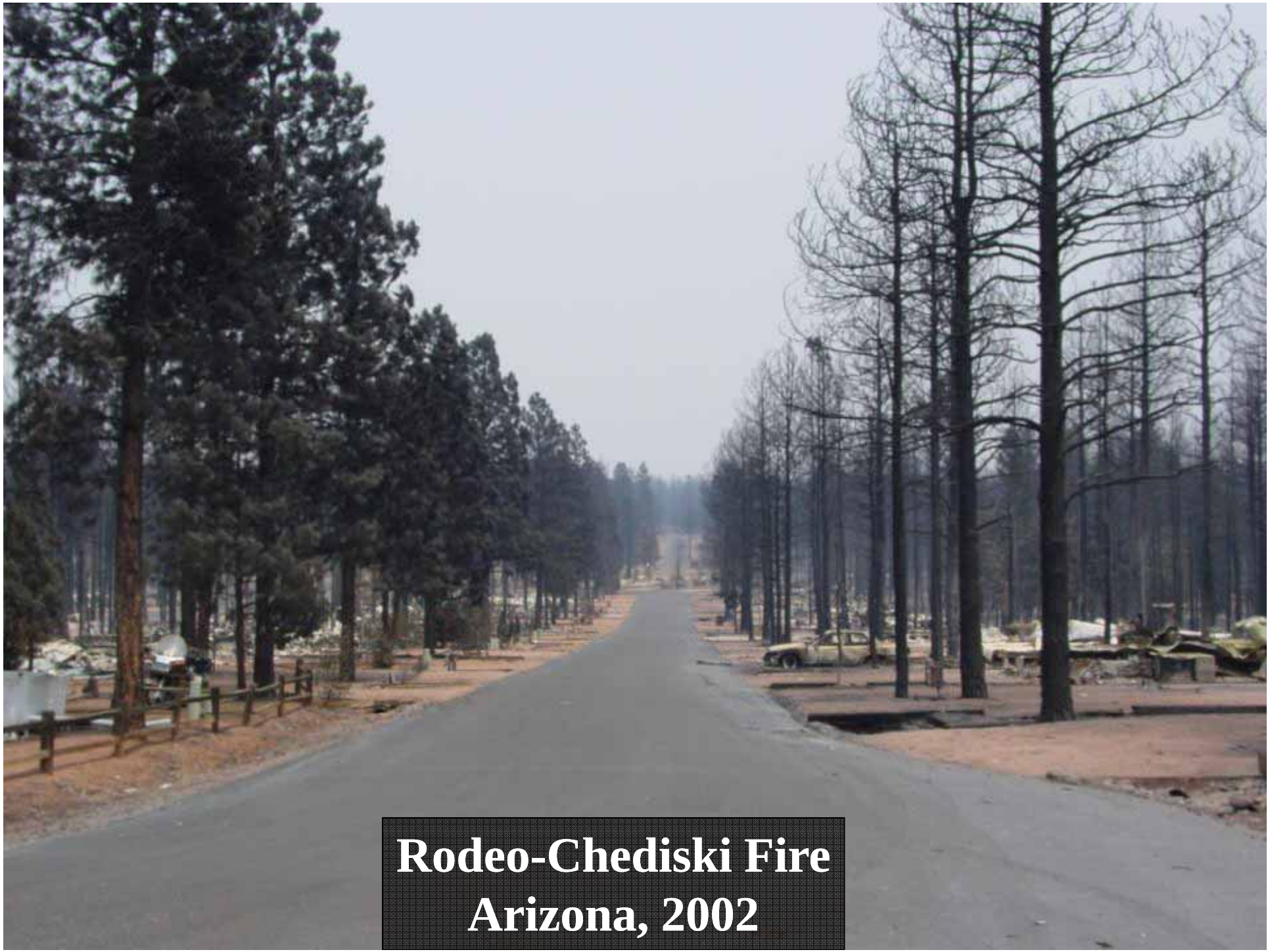

Photo time
1800

Los Alamos, 2000

Examination findings:

High intensity wildfires typically do not continue spreading through residential developments.


Angora Fire, June 2007
Lake Tahoe, CA


Rodeo-Chediski Fire
Arizona, 2002

Research Indicates:

Homes meet the requirements for ignition based on local conditions.

Research Indicates:

Given extreme wildfire behavior, the home characteristics in relation to the area surrounding the home within 30 m (100 ft) principally determine the potential for home ignitions. I call this the –

home ignition zone (HIZ).


HOME IGNITION ZONE

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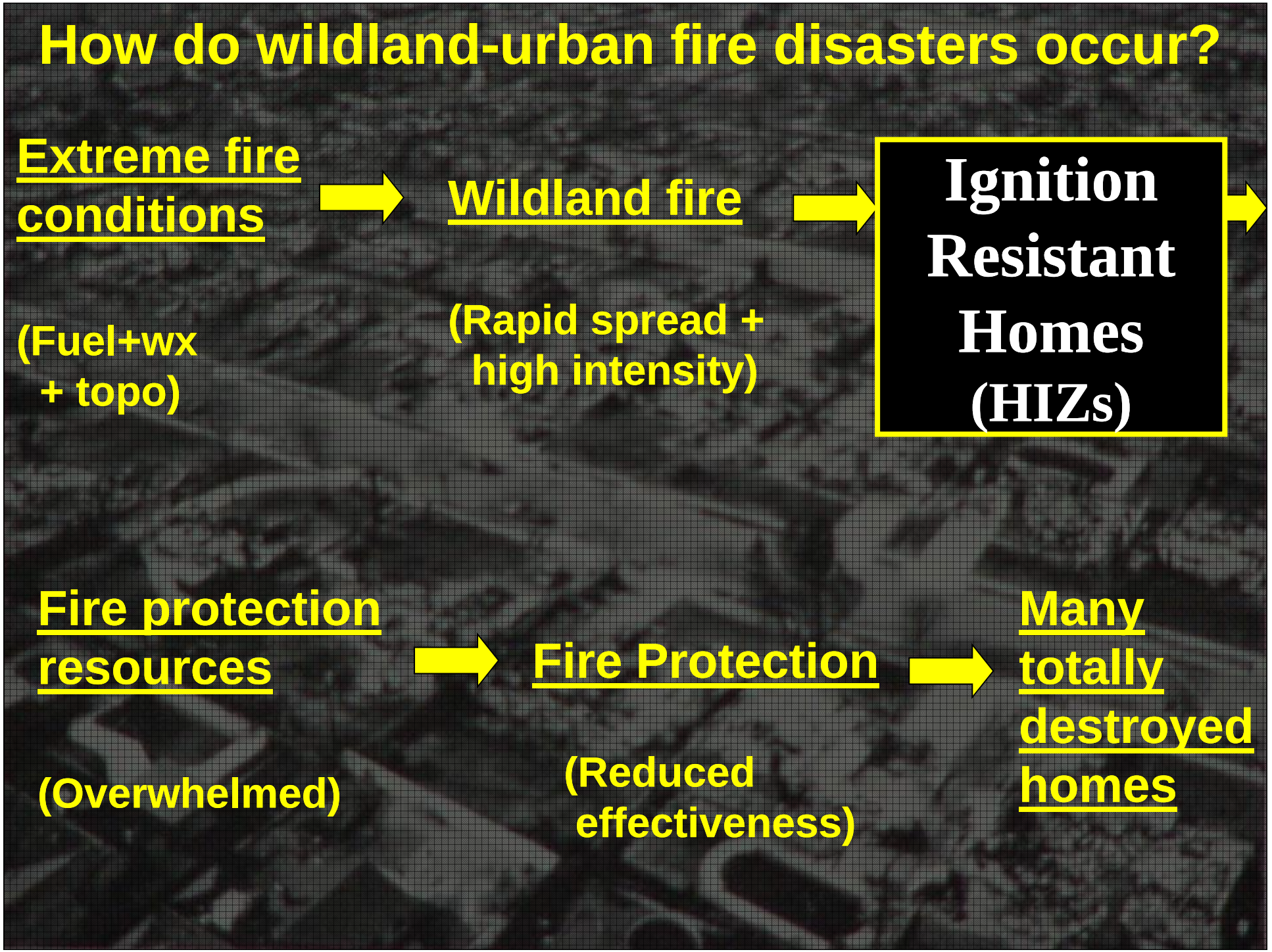

How do wildland-urban fire disasters occur?

Extreme fire conditions → **Wildland fire** → **Ignition Resistant Homes (HIZs)**

(Fuel+wx + topo)

(Rapid spread + high intensity)

Fire protection resources → **Fire Protection** → **Disaster Prevented**

(Proportional)

(Enhanced effectiveness)

Home Ignition Zone (HIZ) provides the basis for the approach currently taken by the U.S. Firewise Program and others…

And complements and supports the viability of program methods such as:

- ***Ready, Set, Go***
- ***Prepare to Stay and Defend, or Leave Early***


Thank you