

# *The Science of Ignition*

*New Mexico WUI Summit, 2017*

*Albuquerque, NM*

*Hank Blackwell*

# *Wildland Urban Home Destruction*

- *Why do some homes burn while others do not?*
  - *Why are totally destroyed homes surrounded by or next to unconsumed vegetation?*

# *Conditions and Ignition*

- *Homes commonly ignite and burn hours after the wildfire has ceased its extreme fire behavior*
- *Home destruction becomes independent of the wildfire...*
  - *Fire only spreads to locations where the requirements for combustion are met*



# *Wildland-Urban Fuel*

Homes



Flames and  
Firebrands



# *Ignition of Combustibles*



*Flaming combustion  
burns flammable  
vapors*



*Smoldering/glowing  
combustion burns  
surface carbon  
(char)*

# Smoldering Combustion



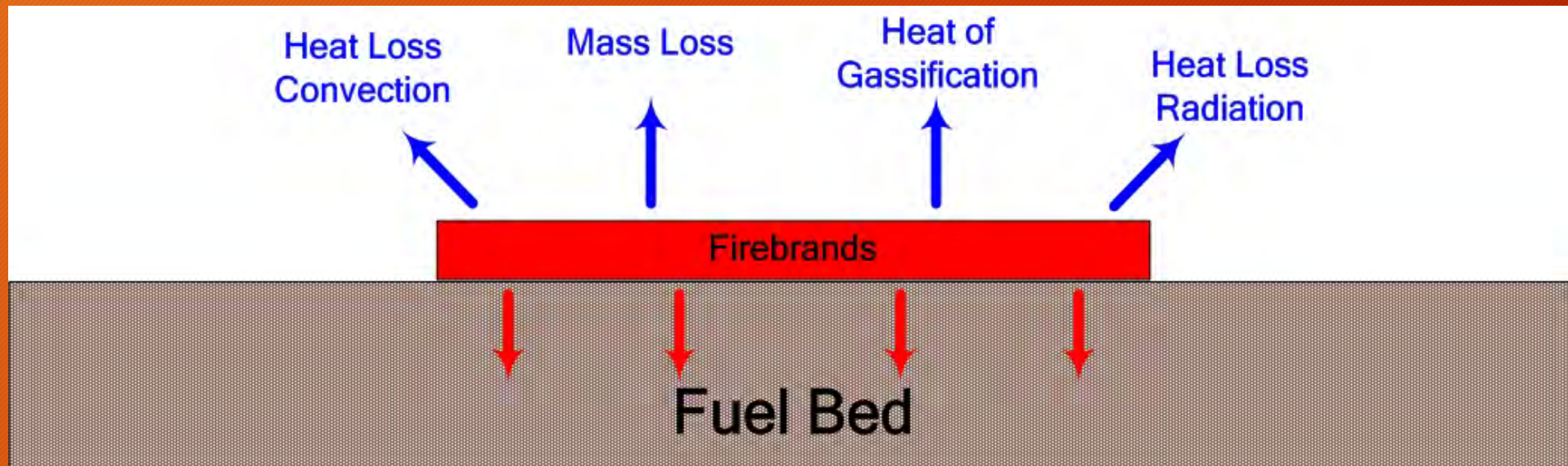
- Solid fuel is heated creating char (carbon).
- As the carbon oxidizes (glowing combustion), fuel gasses are generated and flaming ignition may occur.
- Wind can accelerate this transition to flaming ignition.



*View from under the deck*

*The transition from smoldering to flaming may take a significant amount of time.*

# Firebrand Ignition



- *For ignition to occur the fuel must be arranged so that heat loss is minimized such as a crevice or gap in roofing materials or decking.*
- *Heat transfer into the fuel bed is by conduction.*



# *How is heat transferred to the home?*

- ✓ *Conduction*
- ✓ *Convection*
- ✓ *Radiation*



# Conduction



- Heat transfer to another body by direct contact or within a body.
- Heat transfer into the wall by conduction depends on:
  - ✓ A temperature difference between an object's surface and its interior.

# Convection

*Heat transfer by convection is dependent on:*

- ✓ *Hot gases/flames making contact with a surface.*
- ✓ *The temperature difference between the gases and the surface.*



# Radiation

- Heat transfer by way of electromagnetic energy.
- Net radiant energy is transferred from the surface of a hotter object to the surface of a cooler object.
- Heat felt at a distance from the radiating object without physical contact.
- Radiation energy intensity decreases rapidly with distance.





# *How Are Homes Ignited by Wildfire?*



*High Intensity  
Crown Fire*



*Firebrands*



*Surface Fire*

# Wildland-Urban Fire Issue

- *A wildland-urban fire is where the fuel being consumed by a wildfire changes from wildland fuel to urban fuel.*
- *The wildfire must be close enough for flying brands and/or flames to contact the ignitable portions of a structure.*
- *The exposure must be long enough to cause flaming ignition.*



# *Changing Our Approach*

- *Focus on mitigation/preventative actions before the event that reduce ignition potential.*
- *Reduce the structure's ignitability...*

*to effectively stop the transition from a wildland fire to an urban fire and thus, prevent the WU fire disaster.*



# *Questions & Discussion*

