Building Costs & Risk Modeling to Reduce Community Wildfire Risk
Examples of Community Tools

- Landscaping Regulations
- Forest Management Projects
- Watershed Management Plans
- Land Preservation Tools
- Building Codes
- Subdivision Design Standards
- Local Governments
- Steep Slope Ordinances
- Land Use and Development Codes

Community Planning Assistance for Wildfire
Costs to Building a Wildfire-Resistant Home

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Chief Scientist for Wildfire and Durability
Insurance Institute for Business & Home Safety
• What are the vulnerable features in a home?
• How can they be made resistant to wildfire?
• What does it cost?
Today

- Methods
- Preliminary Results by Component
- Putting it All Together
- Key Take-Aways
Today

• Methods
• Preliminary Results by Component
• Putting it All Together
• Key Take-Aways
Baseline Home

- Park County, MT
- 3 bedroom
- 2500 sq. ft.
- Approx. $350,000
Wildfire Resistance: Embers + Radiant Heat
Cost Comparison

- New Construction: swap traditional for wildfire-resistant in 6 most vulnerable components
- Retrofit: remove and replace with wildfire-resistant components
- Cost from RSMeans:
  - National database with regional multipliers
  - Includes labor, overhead & profit
  - Allows consistency
  - Limits localized variability
1. Roof
Vulnerable Components

1. Roof
2. Exterior Walls
Vulnerable Components

1. Roof
2. Exterior Walls
3. Windows
Vulnerable Components

1. Roof
2. Exterior Walls
3. Windows
4. Doors
Vulnerable Components

1. Roof
2. Exterior Walls
3. Windows
4. Doors
5. Deck
Vulnerable Components

1. Roof
2. Exterior Walls
3. Windows
4. Doors
5. Deck
6. Home Ignition Zone
Today

• **Methods**

• **Preliminary Results by Component**

• **Putting it All Together**

• **Key Take-Aways**
Roof
Roof Vulnerabilities

- Roof material, underlayment, edges
Roof Vulnerabilities

• Roof material, underlayment, edges
• Vents
Roof Vulnerabilities

• Roof material, underlayment, edges
• Vents
• Wall-to-roof junctions
Roof Vulnerabilities

- Roof material, underlayment, edges
- Vents
- Wall-to-roof junctions
- Gutter & drip edge
Roof Cost: New Construction

Baseline: $3,815 (23%)
Wildfire-Resistant: $10,000 (27%)

+$3,815
+
## Roof Cost: Retrofit

<table>
<thead>
<tr>
<th>Feature</th>
<th>Cost/Unit</th>
<th>Example Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vents</td>
<td>$400</td>
<td>$400</td>
</tr>
<tr>
<td>Wall-to-Roof Junctions</td>
<td>$18/ sq. ft</td>
<td>$2,200</td>
</tr>
<tr>
<td>Gutter &amp; Drip Edge</td>
<td>$170/ l. ft</td>
<td>$3,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$5,600</strong></td>
<td></td>
</tr>
</tbody>
</table>
Exterior Walls
Exterior Wall Vulnerabilities

- Siding
Exterior Wall Vulnerabilities

• Siding
• Eaves- soffit
Exterior Wall Cost: New Construction

Baseline Wildfire-Resistant Exterior Wall Cost: New Construction

+$6,900 19%

+15%

+19%
## Exterior Wall Cost: Retrofit

<table>
<thead>
<tr>
<th>Feature</th>
<th>Cost/Unit</th>
<th>Example Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siding</td>
<td>$14/sq. ft.</td>
<td>$43,000</td>
</tr>
<tr>
<td>Soffit</td>
<td></td>
<td>$5,600</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$48,600</td>
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</table>
Window Vulnerabilities

• Frame
Window Vulnerabilities

- Frame
- Glass
Window Cost: New Construction

Baseline Wildfire-Resistant

Map: 
- +$3,000 (36%)
- +38%
- +38%
Window Cost: Retrofit

$500 - 900 per window
Doors
Door Vulnerabilities

• Frame
• Weatherstripping
Door Cost

Baseline Wildfire-Resistant

+$1,400 22%

+24%  

+26%
Deck
Deck Vulnerabilities

- Decking surface
Deck Vulnerabilities

- Decking surface
- Tape
Decking Cost Options

- Treated Lumber
- Redwood
- Composite
- PVC
- Composite Woodgrain
- Composite Capped
- Cedar

Price/Sq. Ft.
Decking Cost Options

<table>
<thead>
<tr>
<th></th>
<th>Traditional</th>
<th>Wildfire-resistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated Lumber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Redwood</td>
<td>20.00</td>
<td></td>
</tr>
<tr>
<td>Composite</td>
<td>15.00</td>
<td></td>
</tr>
<tr>
<td>PVC</td>
<td>10.00</td>
<td></td>
</tr>
<tr>
<td>Composite Woodgrain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite Capped</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cedar</td>
<td>25.00</td>
<td></td>
</tr>
</tbody>
</table>
Deck Cost

Baseline

Wildfire-Resistant

+$5,800
60%

+29%

+28%
Home Ignition Zone Vulnerabilities

- 5-feet within structure
- Under deck surfaces
Home Ignition Zone Cost

Baseline Wildfire-Resistant Home Ignition Zone Cost

- Baseline: $0
- Wildfire-Resistant: +$2,600 (210%)
- Additional Increases:
  - +259%
  - +283%

Map showing increases in cost across different regions.
Today

• Methods
• Preliminary Results by Component
• Putting it All Together
• Key Take-Aways
Difference by Component

Baseline: Wildfire-Resistant
Baseline Home | Wildfire-Resistant Home

| $0 | $0 |
| $50,000 | $25,000 |
| $100,000 | |
| $150,000 | |
| $200,000 | |
| $250,000 | |
| $300,000 | |
| $350,000 | |
| $400,000 | |

+$25,000
7%

Vulnerable features
Wildfire-resistant features
Unchanged features
Cost Savings from Co-Benefits

- Wildfire Resistant
- Energy Efficient
- Longer Lifespan
- Lower Maintenance
Today

• **Methods**
• **Preliminary Results by Feature**
• **Putting it All Together**
• **Key Take-Aways**
Six of the most vulnerable features make up 20-25% of a home’s cost.
Making those components wildfire-resistant adds 6-10% to the total cost of the home.
Exterior walls, deck, and roof comprise the majority of increased expense.
Thank You!

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Wildfire Risk Assessments

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Today

• Why use risk assessments
• Methods & data
• Products
Today

• Why use risk assessments
• Methods & data
• Products
Managing Wildfire Across Boundaries

- Cross-boundary fire management is key to achieving the Cohesive Strategy goals
  - Fire adapted communities
  - Restore and maintain resilient landscapes
  - Safe and effective wildfire response
- Mapping risk from large wildfires and partitioning it among landowners and communities is a complicated problem
- New concepts and tools are needed to build a common understanding of cross-boundary risk
The Role of Wildfire Risk Assessments

• Pre-Fire Planning
  • Treatment prioritization and strategic fuels management
  • Identifying stakeholders
  • Community planning (WUI codes, regulations, CWPP)

• Wildfire Response
  • Delineation of wildfire response zones
  • Effective communication between agency officials, incident management teams, and the public

• Overall: consideration of wildfire in land use planning and land management
Today

- Why use risk assessments
- Methods & data
- Products
What is a Wildfire Risk Assessment?

- Wildfire Risk: A measure of the probability and consequences of uncertain future wildfire events.

- Wildfire Hazard: A physical situation with potential for negative consequences from wildfire.

- Wildfire Exposure: The spatial intersection of wildfire hazard with something of value.
Methods: Gather Input Data

Stakeholder Input & Data

- Fuels
- Topography
- Weather
- Fire Occurrence
- Community Information

Fire Modeling

- Likelihood
- Intensity
- Values
Methods: Fire Modeling

- **FSim**
  - Models a wide range of conditions over an entire season

- **FlamMap**
  - Models a specific weather scenario
Methods: Fire Modeling

National FSim Modeling


Methods: Calculate and Summarize Outputs

- **Pixel-based outputs**
  - Likelihood
  - Intensity

- **Derived metrics**
  - Hazard
  - Exposure
  - Fireshed

- **Summarize to polygons**
  - Watersheds
  - Political Units
  - Neighborhoods
Today

- Why use risk assessments
- Methods & data
- Products
Landscape Assessment

Watershed scale (12-code HUC) – FSim Modeling

Landscape Wildfire Hazard By Subwatershed

Likelihood

Intensity

Hazard
Local Assessment
Smaller watershed scale (catchments) – FlamMap Modeling

Likelihood \times \text{Intensity} = \text{Hazard}
Community Fireshed

- The potential source area for wildfires that could impact the community
- Similar in concept to a watershed
Other Related Products

Wildland Urban Interface

Mitigation Difficulty Map

Based on The 2010 wildland-urban interface of the conterminous United States. https://www.nrs.fs.fed.us/data/WUI/
Other Related Products

Wildfire Exposure and Transmission Analysis
Other Related Products

Wildfire Exposure and Transmission Analysis
Other Related Products

Wildfire Network Analysis
Resources

• Risk assessment information

• National fire occurrence and FSIm modeling data
  • Short and others. 2016. Spatial dataset of probabilistic wildfire risk components for the conterminous United States. https://doi.org/10.2737/RDS-2016-0034

• WUI mapping information and data
  • https://www.nrs.fs.fed.us/data/WUI/

• Community Planning Assistance for Wildfire (CPAW)
  • https://planningforwildfire.org/

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Thank You!

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