Modelling the fire propagation and fire impacts on buildings in the Wildland-Urban Interfaces

Anne GANTEAUME
INTRODUCTION

Context

- Increasing Wildland-Urban Interfaces (WUI) in SE France
INTRODUCTION

Context

- Increasing Wildland-Urban Interfaces (WUI) in SE France => Increasing fire occurrence
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Context

- Increasing WUI in SE France => Increasing fire occurrence

Role of the **ornamental vegetation** as important **vector of fire propagation** towards housing
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Context

- Increasing WUI in SE France => Increasing fire occurrence

Role of the **ornamental vegetation** as important **vector of fire propagation** towards housing

Possible **significant damage** to structures
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Context

Ornamental vegetation => Possible **significant damage** to structures

Due to massive firebrand shower … …or to heat radiating from the flame front
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Context

Ornamental vegetation => Possible significant damage to structures
INTRODUCTION

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Ornamental vegetation => Possible significant damage to structures
INTRODUCTION

Context

Need to better understand the fire behavior in WUI vegetation
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Context

Modelling the Fire Behavior : What’s the status?
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Context

Modelling the Fire Behavior: What’s the status?

Semi-physical network model
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Context

Modelling the Fire Behavior: What’s the status?

Very efficient modelling in **Wildland vegetation**

Common outputs: Fire rate of spread, fireline intensity, flame height, fire perimeter
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Context

Modelling the Fire Behavior: What’s the status?

Very efficient modelling in *Wildland vegetation*

Some attempts at the WUI

*WFDS* simulation code
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What do we need now?

Modelling the Fire Behavior in WUI vegetation

Adapting models because more heterogeneous vegetation in WUI than in wildland
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What do we need now?

Modelling the Fire Behavior in WUI vegetation => impacts on structures

Figure 38 Image showing structure to structure fire spread on primary structures ignited by 18:38.

Photo courtesy of CSFD, used with permission, overlays from NIST
Modelling the Fire Behavior in WUI vegetation: How?

Generating vegetation scenes (2D & 3D)

Georeferenced plants => spatial distribution of vegetation
Species, crown diameter, crown height, total height
METHODOLOGIE

Modelling the Fire Behavior in WUI vegetation: How?

Getting data on the structure of ornamental species

Litter bulk density, litter load, leaf bulk density, leaf SVR, FMC
% dead fuel, % live fuel
METHODOLOGIE

Modelling the Fire Behavior in WUI vegetation : How?

Getting data on the flammability of ornamental species

Flammability experiments:
- Time-to-ignition
- Flaming duration
- Ignition temperature
- Flame height,
- Flame temperature, etc.

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Selecting the model

- **FireWUI**

Based on the fire spread model SWIFFT (De Gennaro 2017)

- Enhanced combustion scheme
- Coupled with a module of fire-induced thermal degradation of structures
- Adding a simplified firebrand modelling
SOME RESULTS

Modelling the Fire Behavior in WUI vegetation

SCENARIO 1:
Vitesse- direction de vent fictives (10m/s - Vent origine Sud-Ouest) // Terrain plat // Jardin sous vent dominant // Pelouse sèche non tondue

Jardin brûlé en 252s d’après la simulation.
SOME RESULTS

Modelling the Fire Behavior in WUI vegetation

SCENARIO 2:
Vitesse/direction de vent fictives (10m/s - Vent origine Nord-Ouest-)
// Terrain plat // Jardin attaqué par le flanc du feu // Pelouse sèche non tondue

Jardin brûlé en 238s d’après la simulation.
SOME RESULTS

Modelling the Fire Behavior in WUI vegetation => impacts on structures
SOME RESULTS

Modelling the Fire Behavior in WUI vegetation => impacts on structures

% façade dégradée par le flux thermique

0%
0,1% - 10%
10% - 20%
20% - 50%
50% - 100%
SOME RESULTS

Modelling the Fire Behavior in WUI vegetation => impacts on structures

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SOME RESULTS

Modelling the Fire Behavior in WUI vegetation => impacts on structures
SOME RESULTS

Modelling the Fire Behavior in WUI vegetation => impacts on structures

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SOME RESULTS

Modelling the Fire Behavior in WUI vegetation => impacts on structures

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SOME RESULTS

Modelling the Fire Behavior in WUI vegetation => impacts on structures

Vegetation managed around housing

Scenario with unmanaged vegetation around housing

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10% - 20%
20% - 50%
50% - 100%
FUTURE WORKS

Modelling the Fire Behavior in WUI vegetation => impacts on structures

- Using WFDS
  => testing different scenarios of vegetation distribution around the house
FUTURE WORKS

Modelling the Fire Behavior in WUI vegetation => impacts on structures

➢ Using WFDS

=> testing different scenarios of vegetation distribution around the house

Wind direction => most likely fire direction

Firewise scenario: Thinning
FUTURE WORKS

Modelling the Fire Behavior in WUI vegetation => impacts on structures

- Using WFDS
  => testing different scenarios of vegetation distribution around the house

Wind direction => most likely fire direction

Unfirewise scenario:
Big tree overhanging the roof

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