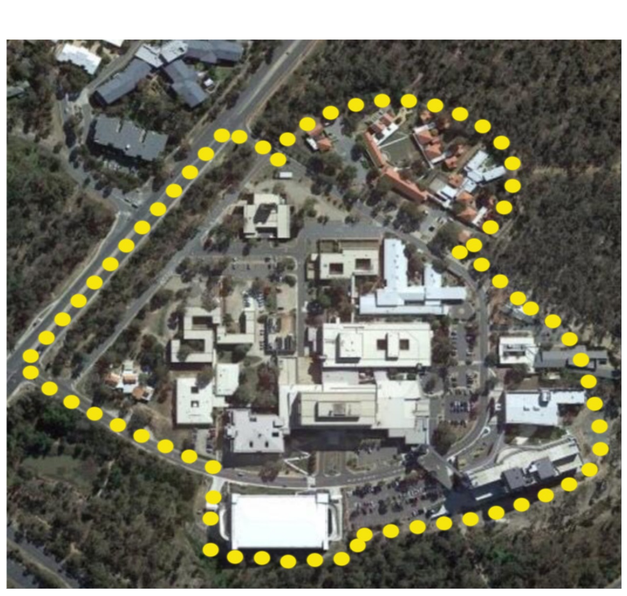
Australia's wildland urban interface

Quantifying bushfire risk to the built environment

The Wildland-Urban Interface (WUI) is defined as the areas where urban and suburban development occur in and near wildland vegetation. Bushfires pose significant threats to the WUI, and hence it is a key consideration in bushfire risk management.

Previously, the WUI has been characterized based on census and land use data and methods developed in the Unites States and Europe. These approaches have been adapted to provide a nationally consistent definition of the WUI in Australia.

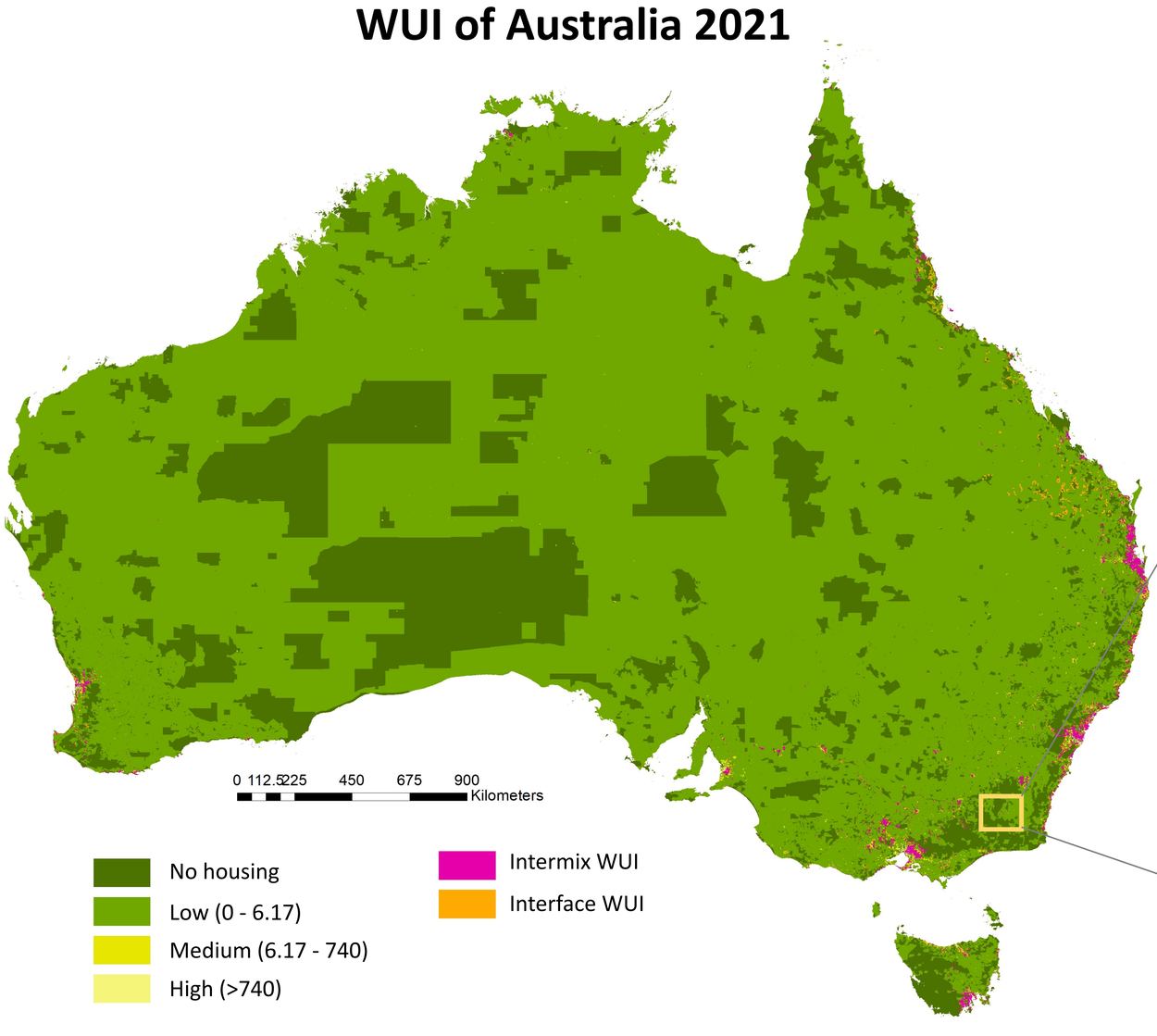


Intermix WUI
Housing and vegetation intermingle.
Housing density > 6.17 houses per km^2 and vegetation density >50%.

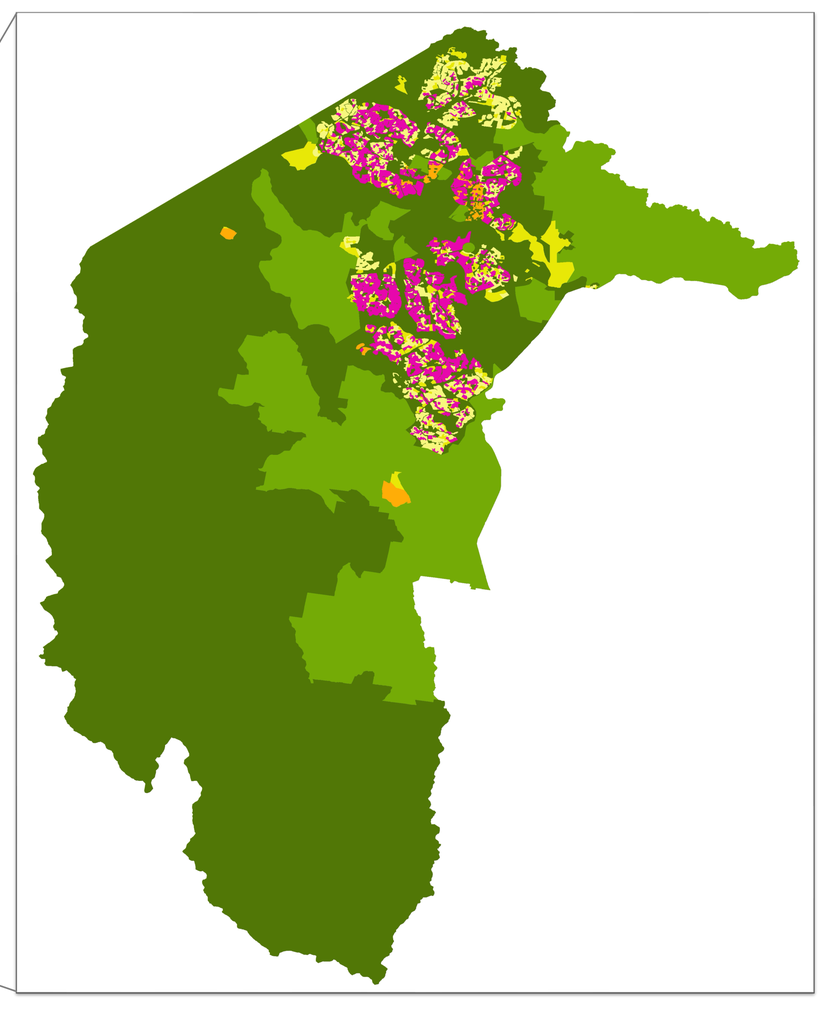
Housing density > 6.17 houses per sq km but vegetation density < 50%

Interface WUI
Developed areas adjacent to wildlands.
Within 2.4km of heavy vegetation >5km^2 and >75% wildland vegetation.

WUI of Australia 2021



WUI of Australian Capital Territory 2021



WUI	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Interface WUI	8.95	668.61	N/A	4246.67	9.87	50.41	245.51	98.12
Intermix WUI	75.18	3418.87	301.00	3613.99	422.31	918.79	1866.23	1117.97

Table 1: *Total area (in km^2) of Intermix and Interface WUI in different states of Australia*

It should be noted that not all the WUI is vulnerable to bushfires. The risks associated with different WUIs depend on factors like prevailing wind conditions, geographic location, fuel type, climatic conditions, terrain, etc. Our WUI dataset will be used in subsequent simulation studies to assess bushfire risk in key areas of interest.

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Simulation of ember storms

Understanding the bushfire threat to the Wildland-Urban Interface (WUI)

Embers are small particles of burning leaves, bark, etc., which have been identified as the leading cause of house loss in bushfires (see Figure 1). They also create secondary ignitions, a phenomenon called ‘spotting’, which can cause damage many kilometres ahead of the actual fire line.

Previous studies of embers treat them as ‘ballistic’ particles that follow a projectile trajectory from their origin to where they land. However, anecdotal and video evidence suggests that embers can creep across the ground, while repeatedly getting lofted and re-lofted. This process is called an ‘ember storm’ (see Figure 2).

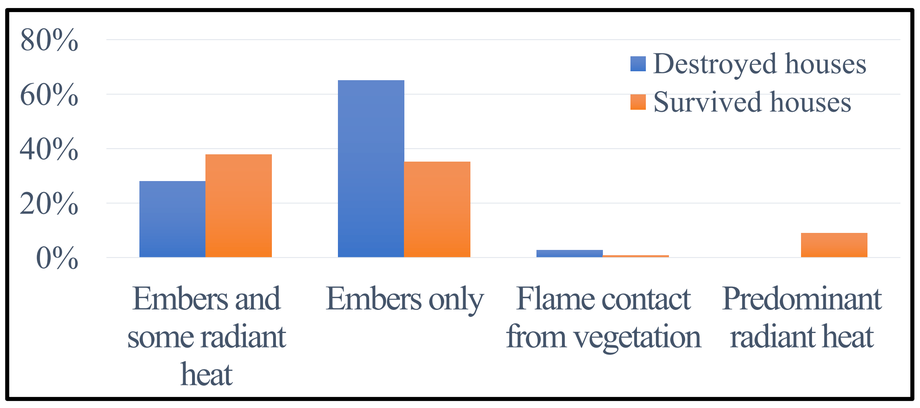

***Fig 1**: Mechanism of bushfire attack on house loss in the ACT Bushfire 2003. Reference: Leonard & Blanchi (2005).*

***Fig 2**: Ember storm during a bushfire on the Sunshine Coast (2019), ABC News.*

We have developed a novel technique that can simulate ember storms at wildland-urban interfaces (WUI): where forest areas meet urban development and structures. The simulation model consists of:

- The forest canopy
- Buildings representing the urban/suburban area
- Embers modelled as particles that exhibit more realistic near-ground behaviour, such as, creep, lofting, and re-lofting processes.

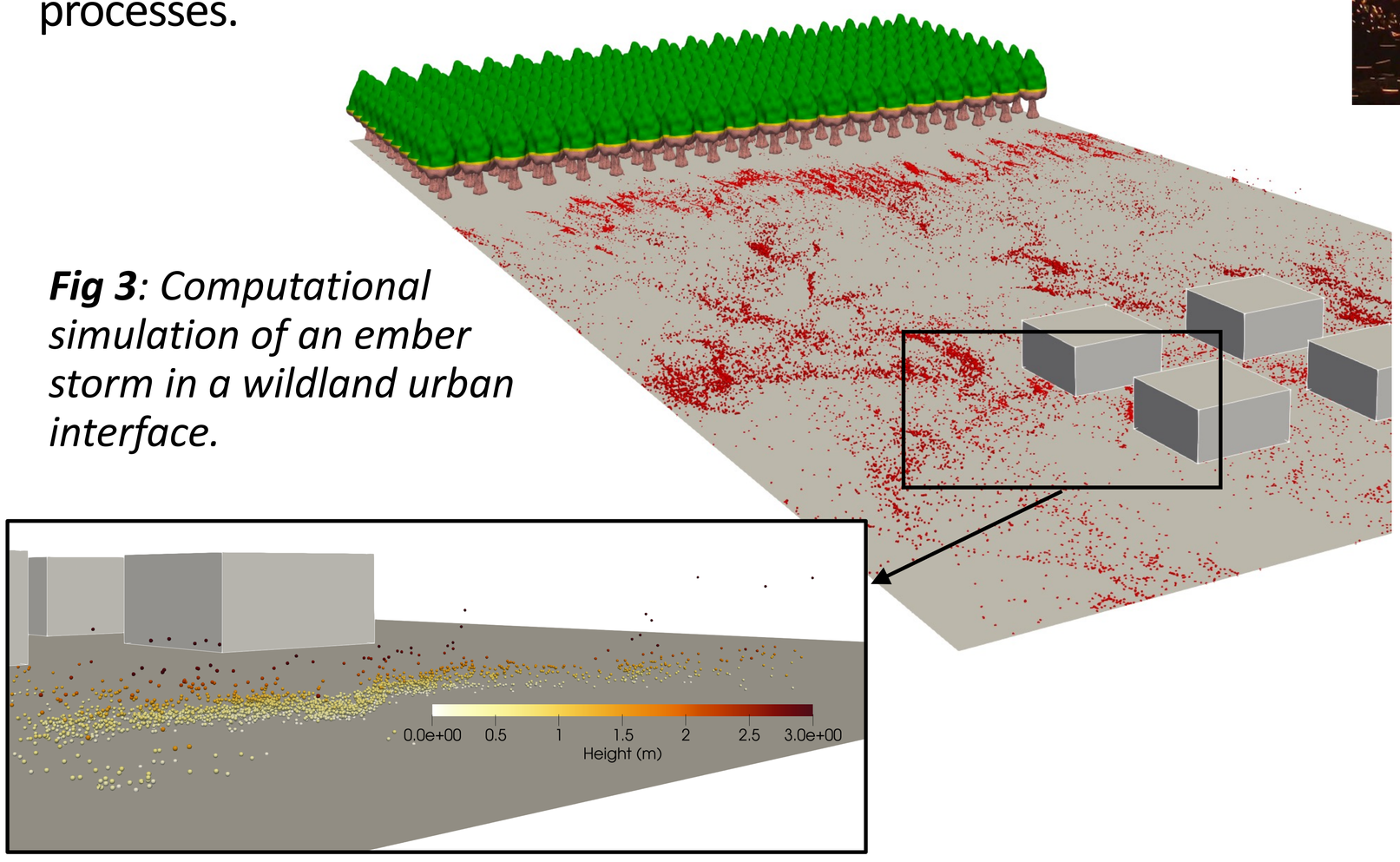

***Fig 3**: Computational simulation of an ember storm in a wildland urban interface.*

Figure 3 displays a snapshot of the simulated ember storm in a WUI. The ember particles (shown as red dots) move from the forest, sliding over and across the cleared land toward the urban area. The motion of the embers near the buildings replicates behaviour observed in actual ember storms.

This study is also exploring mechanisms that can disturb or stall the flow of embers within cleared areas, thereby arresting their movement into urban areas (see Figure 4). Creating turbulence within the cleared area using certain landscape features would likely cause recirculation of the embers and consequently delay their arrival into the urban area; the embers would be more likely to self-extinguish before they can ignite new fires, thus increasing the resilience of communities in the WUI.

***Fig 4**: Schematic of the WUI used in simulations .*

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