

# 4D Fire behaviour simulations



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DARWIN  
UNIVERSITY**

# Fire simulation as a 'serious game'.

- ▶ Implicit vrs explicit learning.
  - ▶ 'Heuristic' Learning by doing
- ▶ Multi-modal learning
  - ▶ Physical 3D models
- ▶ Supporting discussion and exchange of local knowledge

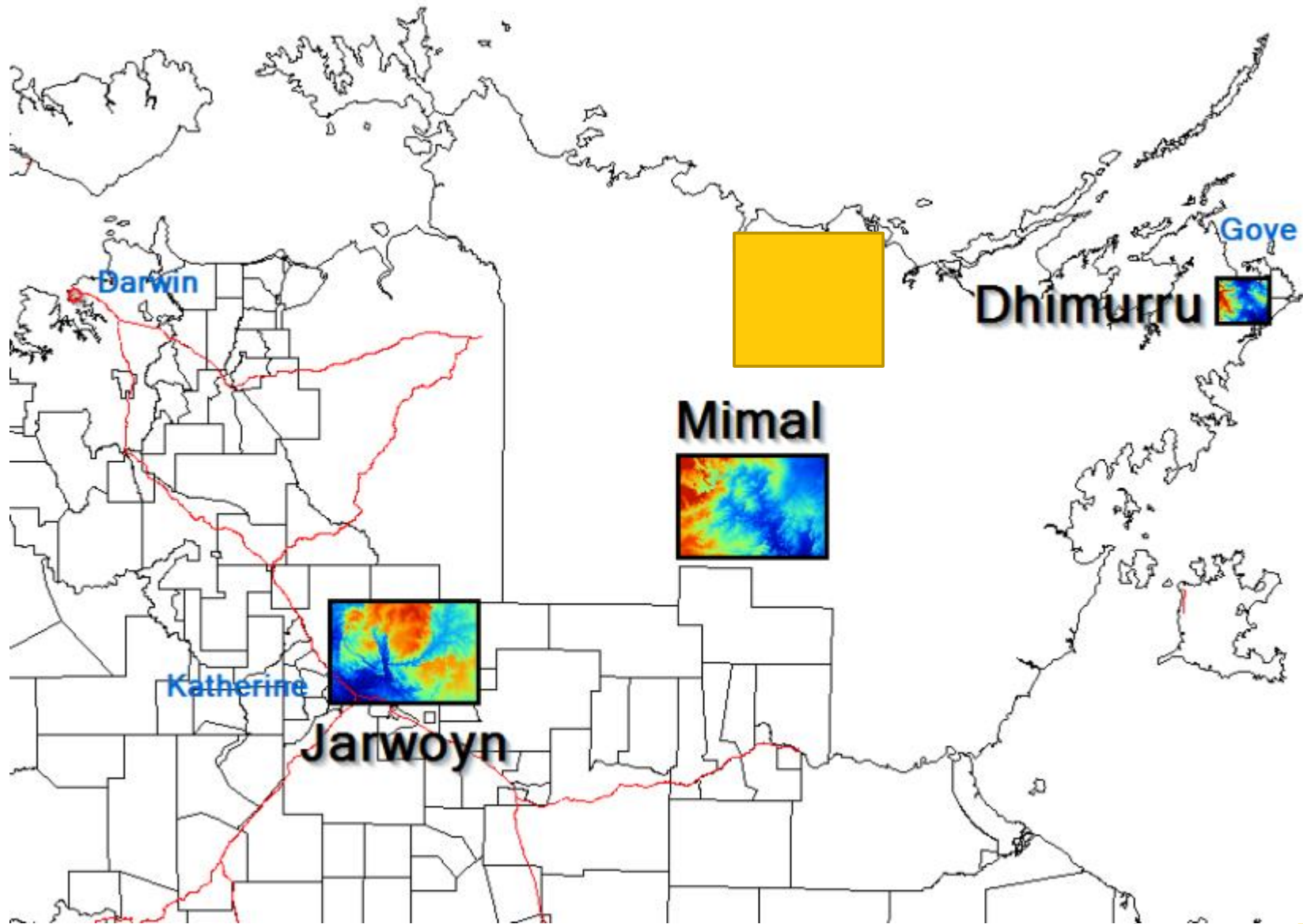


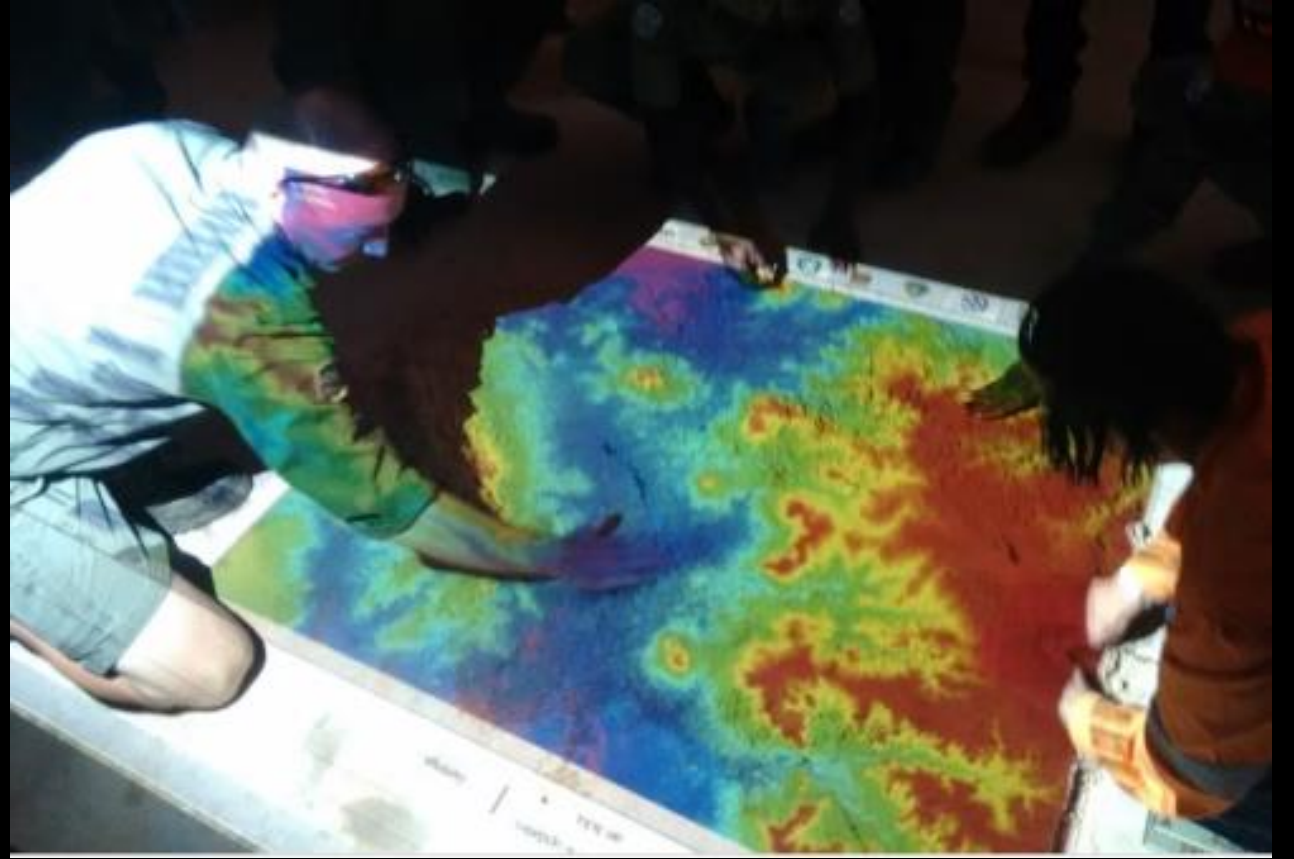
**Multi Sensory**  
**x**  
**Multi Dimensional**  
**x**  
**Play**

Reconfiguring the way we think,  
interact and learn.

# Four Scales

- ▶ Large Regional scale 4000 sqkm (Fuel Reduction)
- ▶ Darwin Region (Darwin River) ~10400ha (Large Scale emergency response)
  - ▶ Simulating large fire event 2018. Large complex fire response planning.
  - ▶ The impact of spotting.
- ▶ Darwin Rural sub region ~ 200ha (Sub-regional complexity)
  - ▶ Currently modelled on a Humptydoo area
- ▶ Multi-Blocks~ 8ha (Personal break and Gamba influence)
  - ▶ Based on idealised block structure





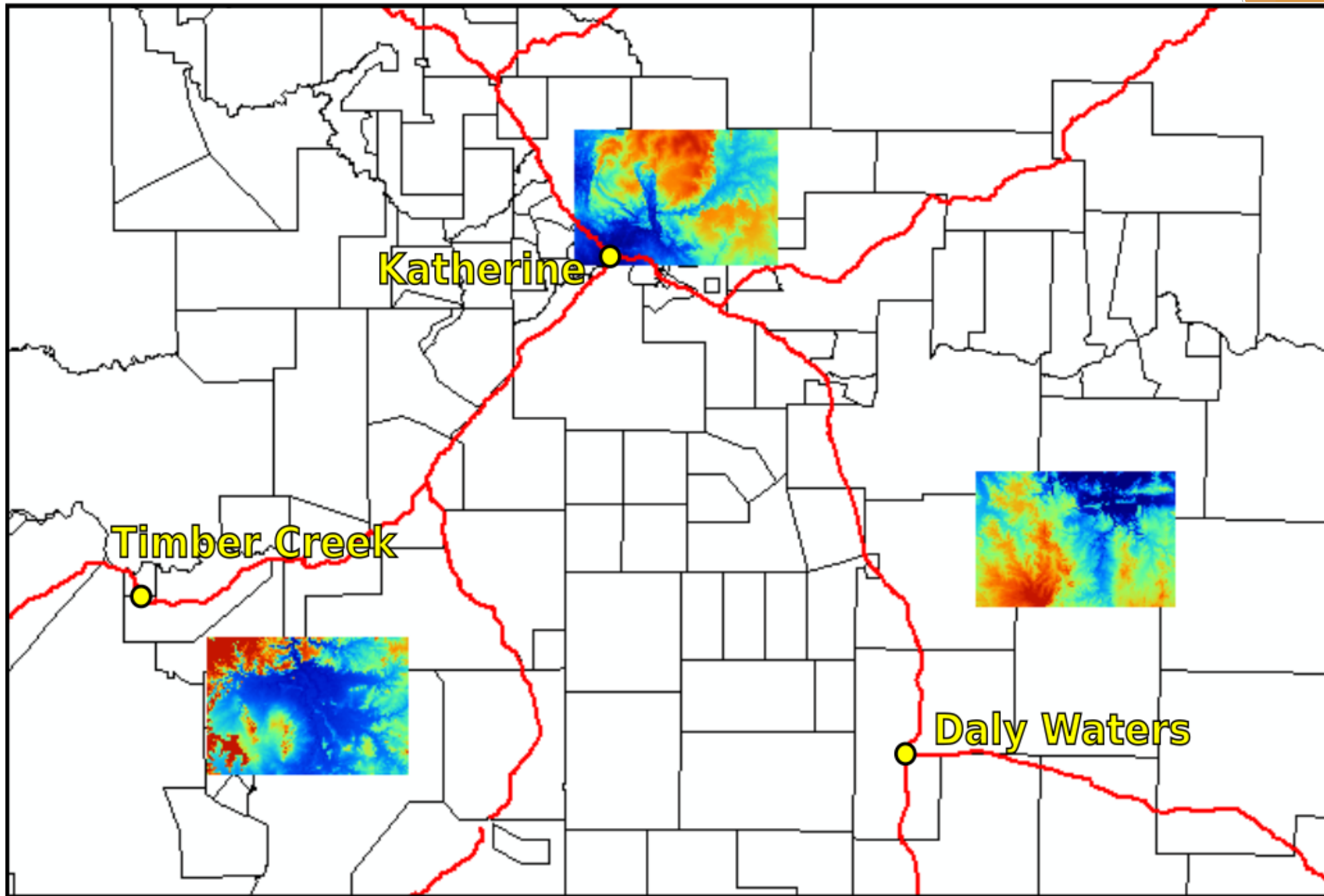
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# 3D BUSHFIRE PROJECTION

a demonstration of  
bushfire behaviour



NORTHERN  
TERRITORY  
GOVERNMENT

### Set Up

Load model 0

### Fire weather variables

Fire\_Danger 10

- 1-3 Very Low
- 4-5 Low
- 6 Medium
- 7-8 High
- 9 Very High
- 10 Severe

wind-speed strong

Change Speed

Wind-Direction NE

set-time noon

SET Fire Weather

### Record

Vid Start Vid Save

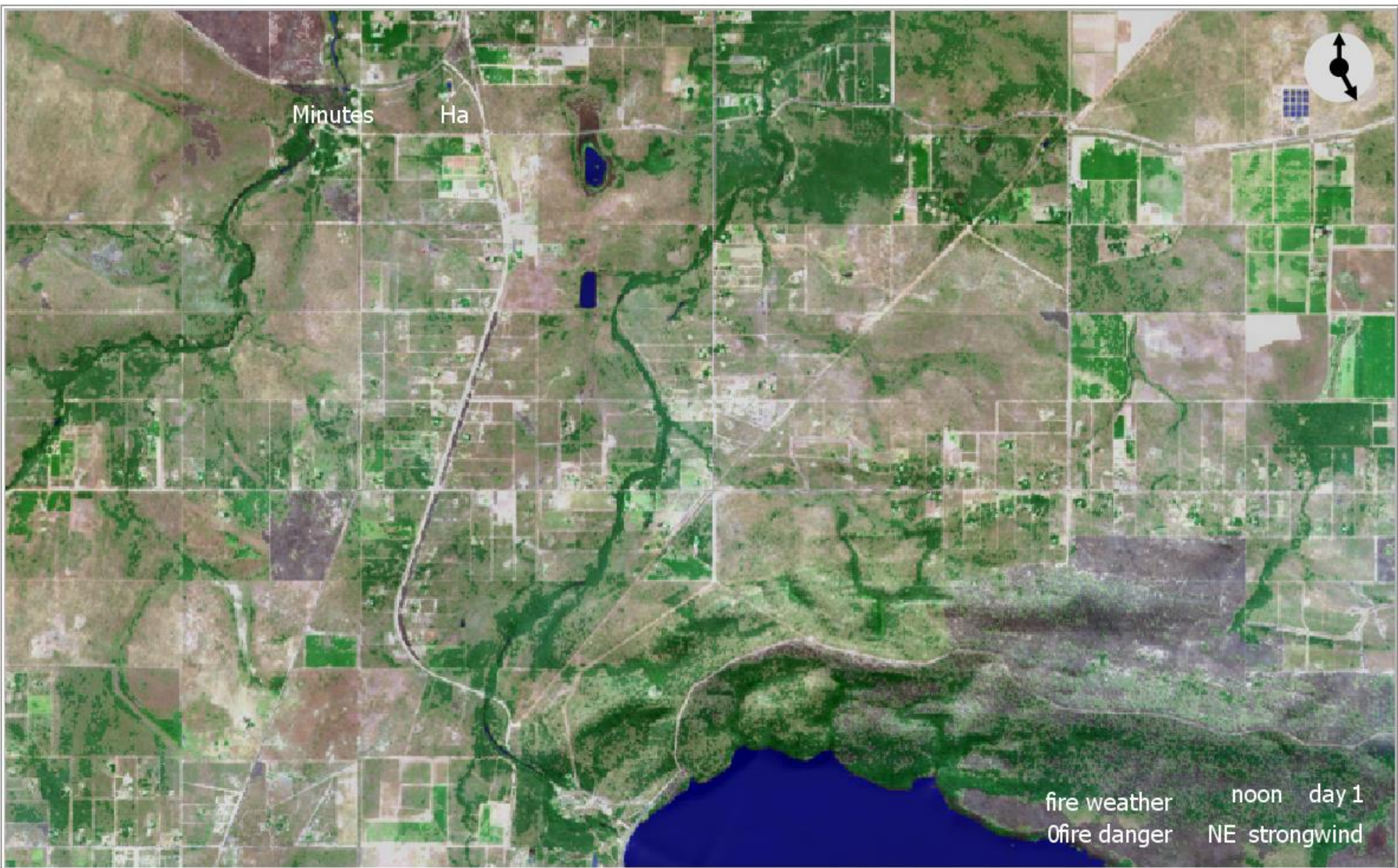
Save Picture

### Options

On Off Stop-if-no-fire

On Off time-of-day

On Off Contiguous\_FL



### Play

Ignite 1 2

Save Ignition 2

GO 2

Ignite Saved 3

Reset

### Layer View

Places H

Tenure 9

elevation

fuel

On Off Total-Gamba-Infestation

On Off Infrastructure-Explode

### Additional Settings

Fire Break 2

grow-gamba 2

protect-area 2

Lightning 1

Average\_Burn

# Darwin River fire simulation.

These simulations show possible fire spread outcomes under differing fire weather conditions.



## Set Up

Load model 0

## Fire weather variables

Fire\_Danger 5

- 1-3 Very Low
- 4-5 Low
- 6 Medium
- 7-8 High
- 9 Very High
- 10 Severe

wind-speed  
light

Change Speed

Wind-Direction  
E

set-time  
noon

SET Fire Weather

## Record

Vid Start Vid Save

Save Picture

## Options

Stop-if-no-fire

time-of-day

Contiguous\_FL



## Play

Ignite 1 Save Ignition 2

GO 2 Ignite Saved 3

Reset

## Layer View

Places H

Tenure 9

elevation

fuel

Total-Gamba-Infestation

Infrastructure-Explode

## Additional Settings

Fire Break 2

grow-gamba 2

protect-area 2

Lightning

Average\_Burn

fire weather noon day 1  
0 fire danger E light wind

## Set Up

Load model 0

## Fire weather variables

Fire\_Danger 16

1-3 Very Low  
4-5 Low  
6 Medium  
7-8 High  
9 Very High  
10 Severe

wind-speed  
strong

Change Speed

Wind-Direction  
E

set-time  
afternoon

SET Fire Weather

## Record

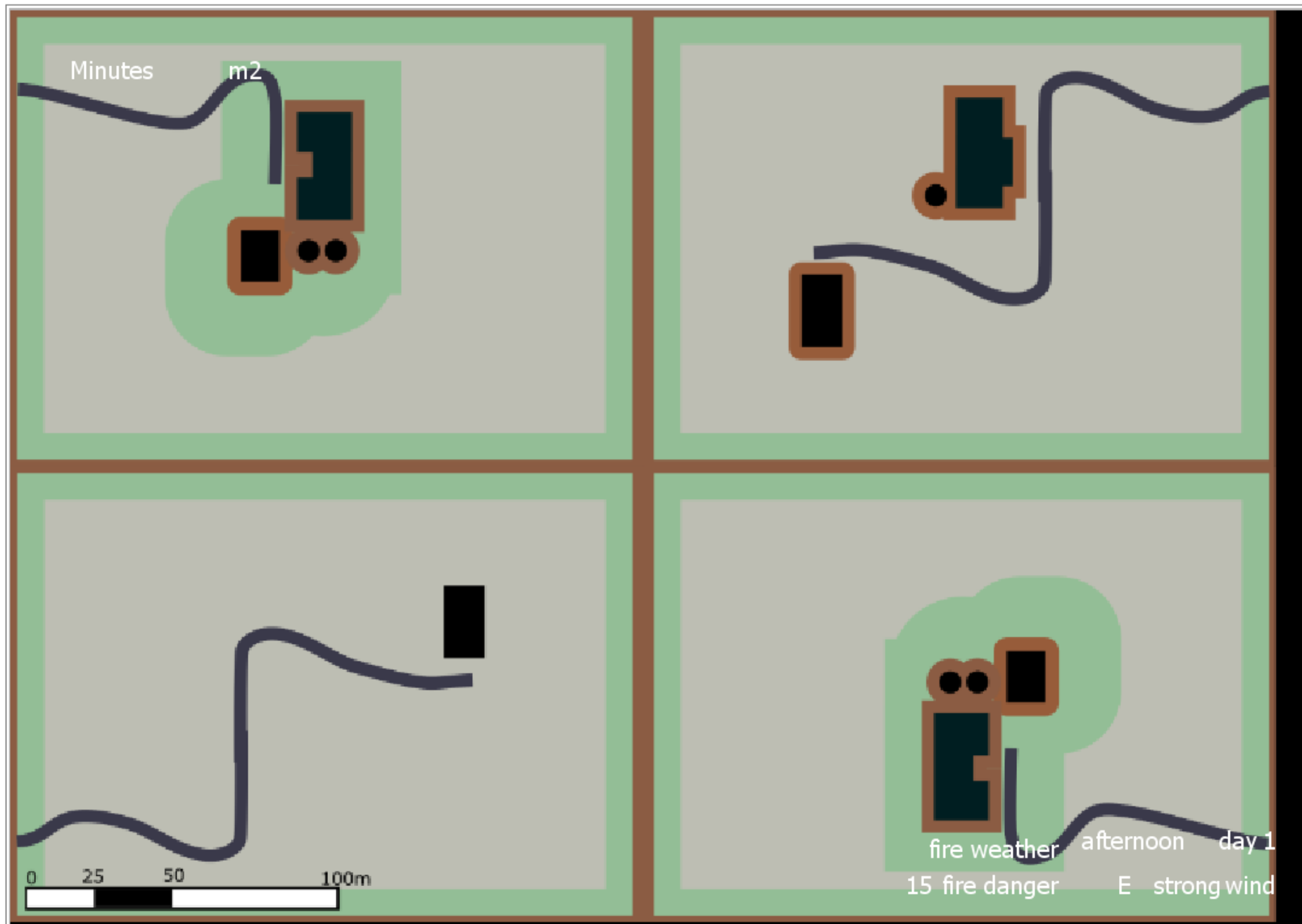
Vid Start Vid Save

Save Picture

## Options

On Off Stop-if-no-fire

On Off time-of-day



## Play

Ignite 1 Save Ignition 2

GO 2 Ignite Saved 3

Reset

## Draw Fuel

Fire Break 2 Remove Break 2

Draw Gamba 2 protect-area 2

## Gamba Infestation

gamba-infest-level 90 B1 B2

B3 b4

## Buildings Explode

On Off I-Explode

## Show Burn Time

5 Min Intervals Continuous

## Layer View

View 1 H View 2

Lightning 1

Average\_Burn

### Set Up

Load model

### Fire weather variables

Fire\_Danger 5

- 1-3 Very Low
- 4-5 Low
- 6 Medium
- 7-8 High
- 9 Very High
- 10 Severe

wind-speed strong

Change Speed

Wind-Direction E

set-time noon

SET Fire Weather

### Record

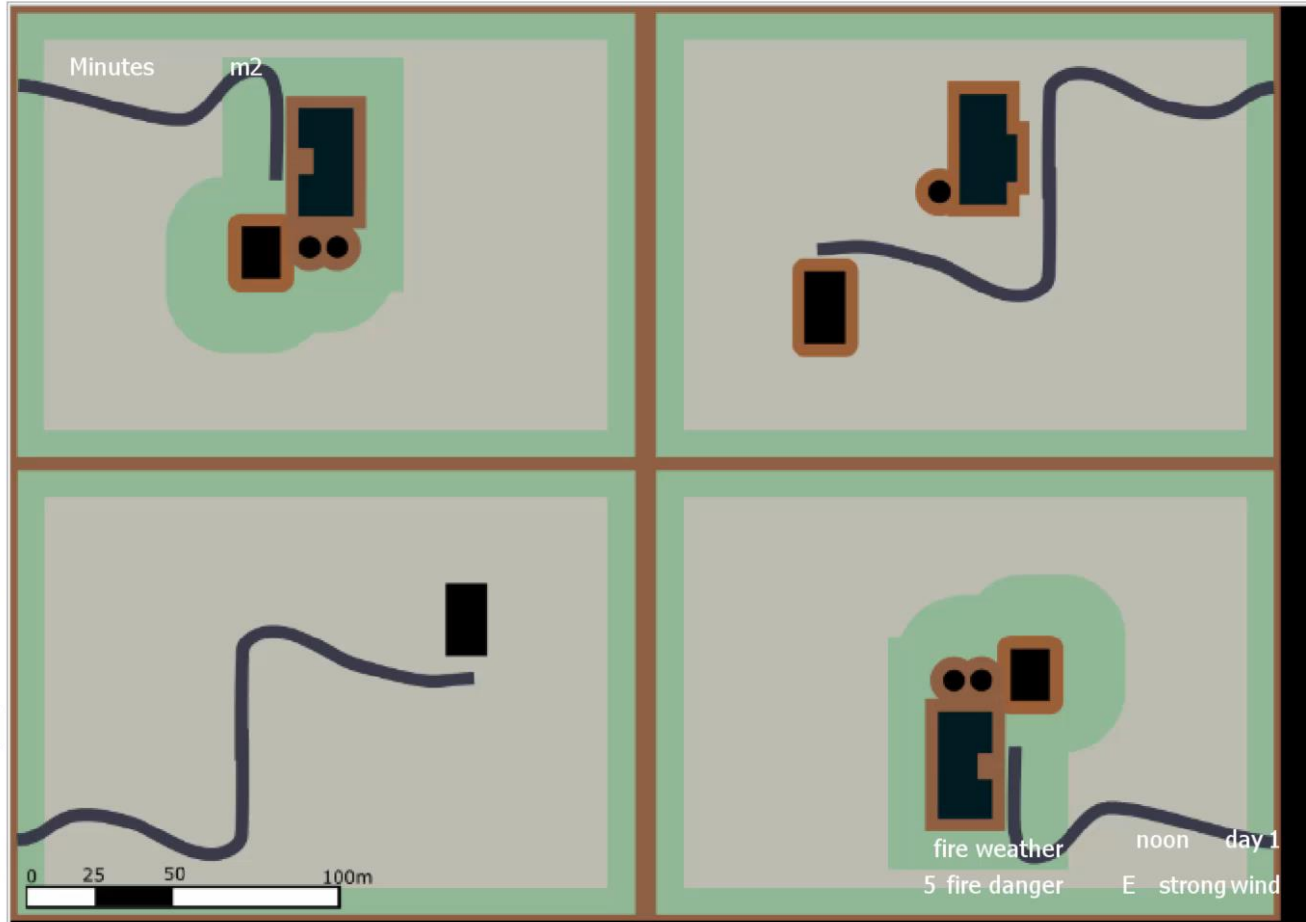
Vid Start Vid Save

Save Picture

### Options

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On Off time-of-day



### Play

Ignite 1 Save Ignition 2

GO 2 Ignite Saved 3

Reset

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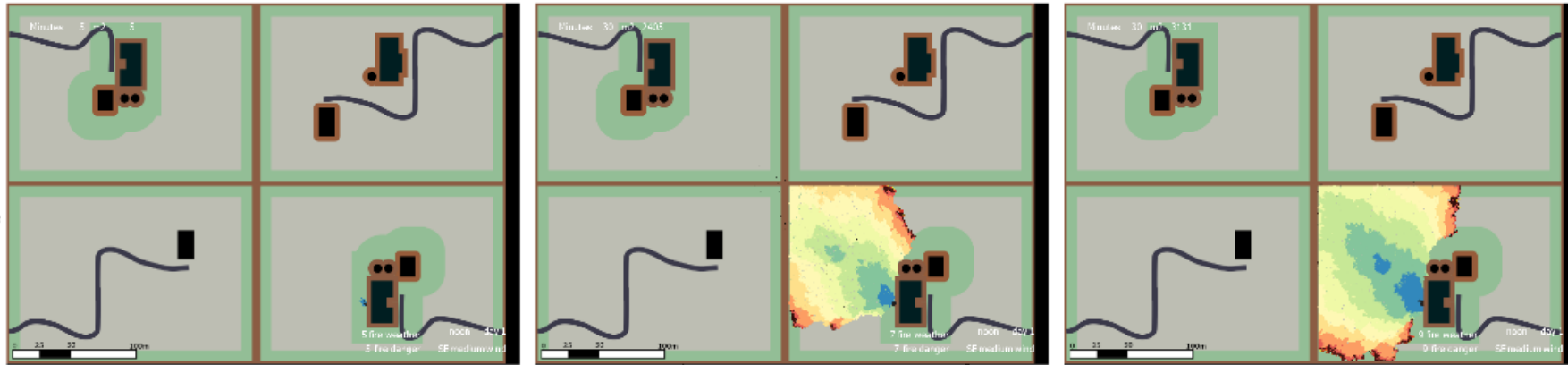
Lightning

Average\_Burn

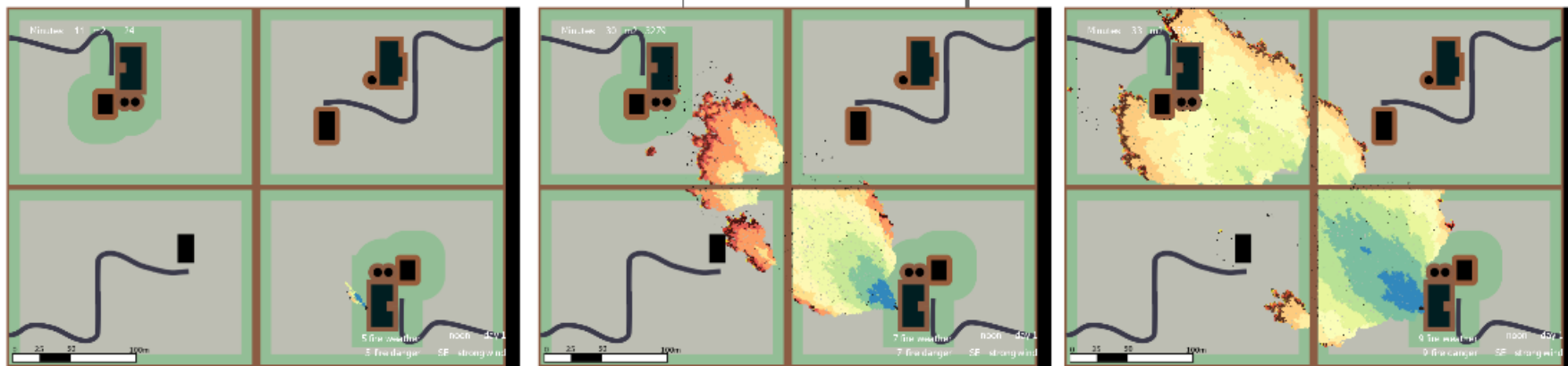
**Light  
Wind**



**Medium  
Wind**  
Spotting Possible



**Strong  
Wind**  
Spotting Probable



30min Simulation runs under multiple fire weather conditions - Darwin Rural Zone. NDRP project.



### Set Up

Load model

### Fire weather variables

Fire\_Danger 5

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Change Speed

Wind-Direction  
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SET Fire Weather

### Record

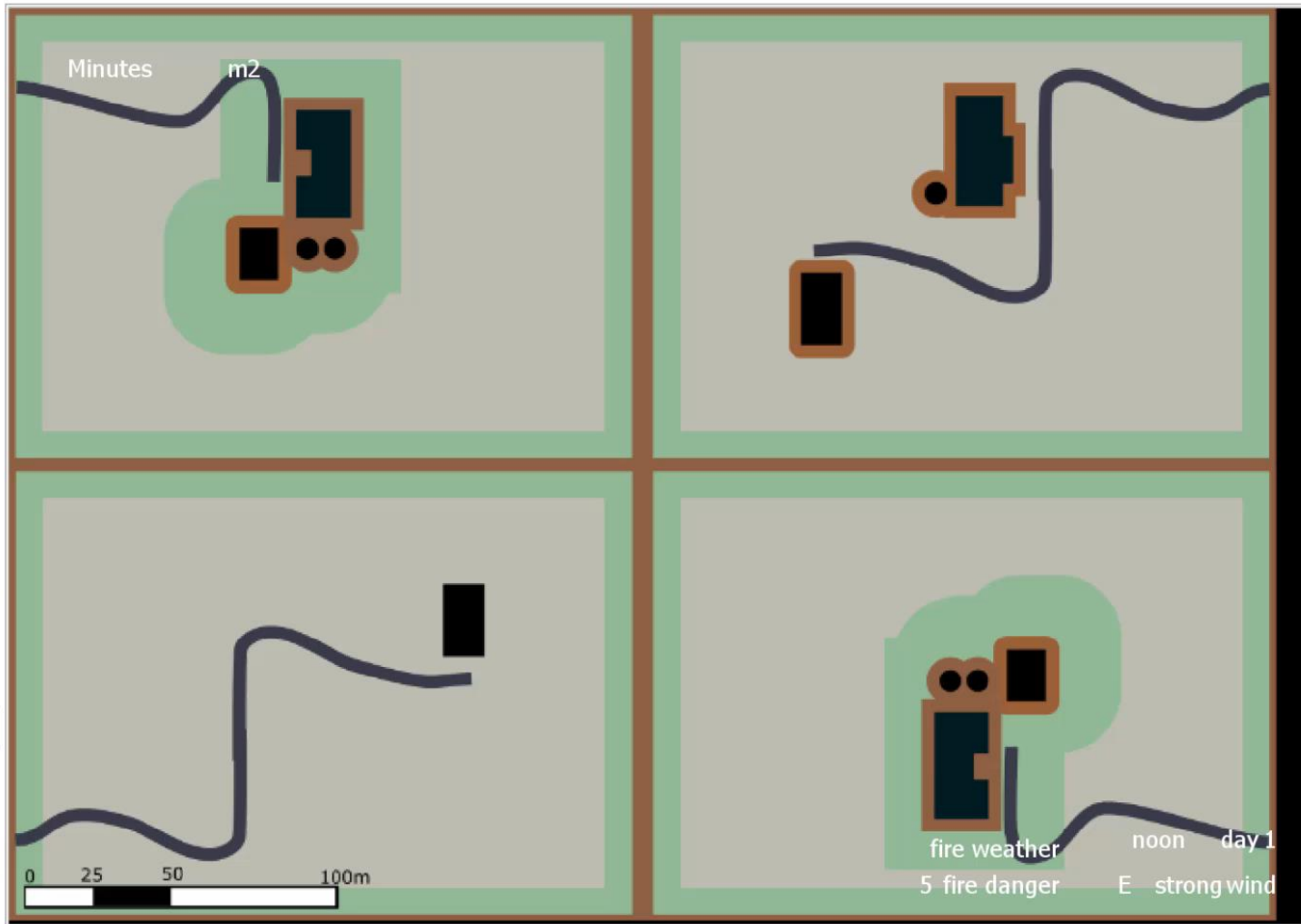
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Save Picture

### Options

On Off Stop-if-no-fire

On Off time-of-day



### Play

Ignite 1 Save Ignition 2

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Reset

### Draw Fuel

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### Gamba Infestation

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### Buildings Explode

On Off I-Explode

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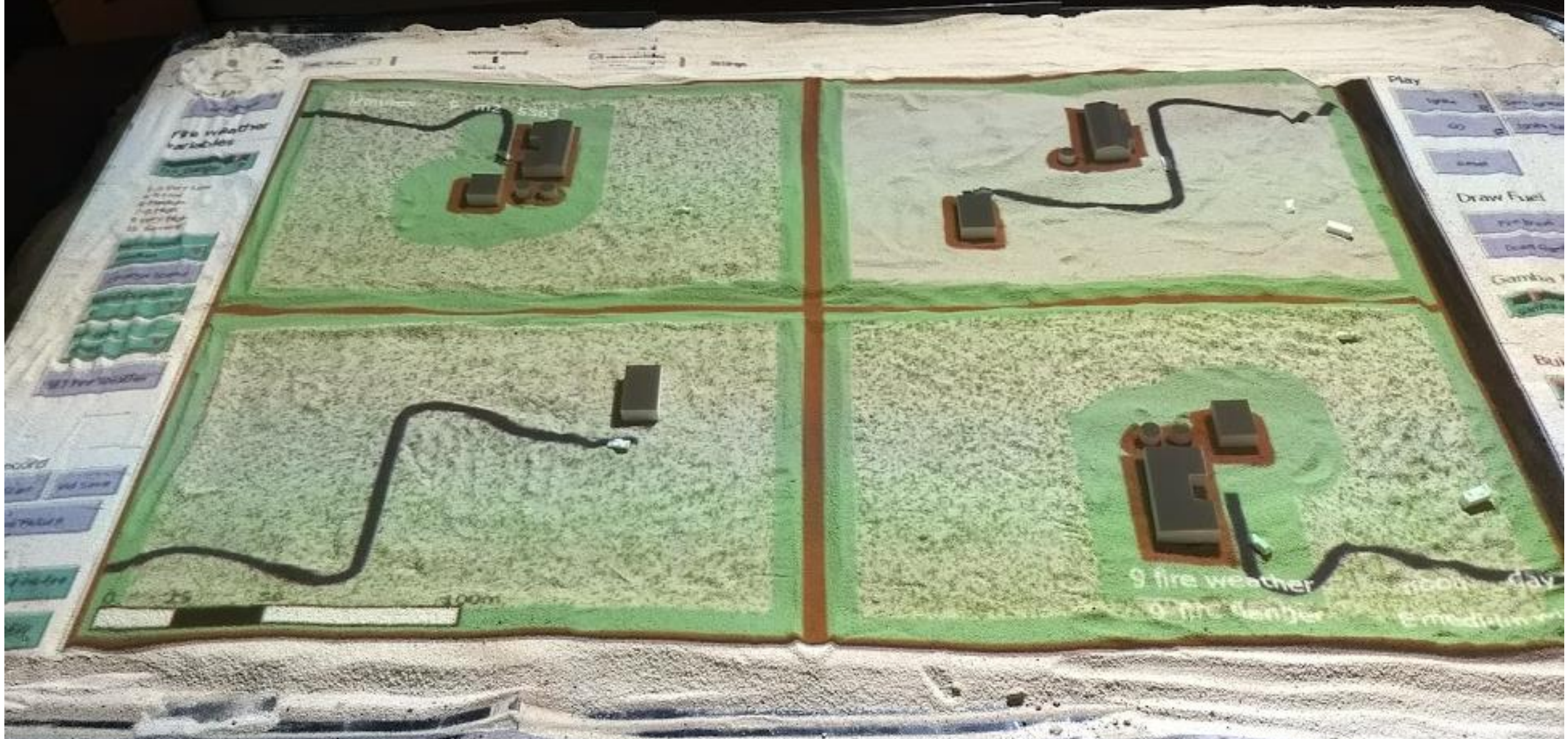
5 Min Intervals Continuous

### Layer View

View 1 View 2

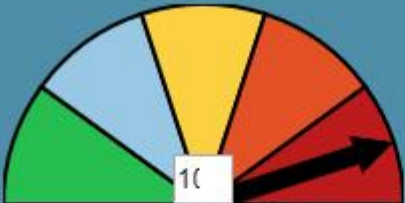
Lightning

Average\_Burn



# Web Version

**WEATHER VARIABLES**



**FUEL DANGER LEVEL**

10

**WIND SPEED**

Strong

**WIND DIRECTION**

