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# WHAT IS A PATCH ?

## Improving spatially explicit individual-based simulations by dividing continuous habitat patches



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### 1 Context

#### Main goal

Simulate red squirrel population dynamics, including dispersal, using a spatially explicit individual-based model



#### Problem encountered

With usual habitat patch definition (contiguous sets of habitat cells) simulated dispersal flows are not realistic :  
No dispersal within large contiguous forested areas

#### Question

How does a more species-specific definition of habitat patches modify simulation outputs in terms of individual dispersal?

### 2 Methods

Spatially-explicit individual-based model: **RangeShiftR**



#### Simulations

- 60 years
- 10 replications
- literature-based demographic parameters
- step-by-step dispersal based on landscape resistance (SMS)

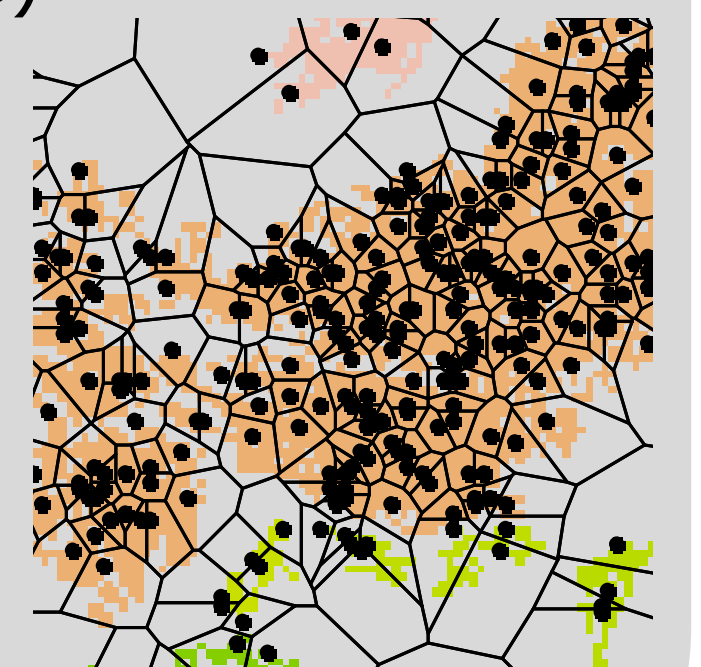
#### Study area

- 16x16 km area in southern France, Alpilles mountains

#### Patch cutting

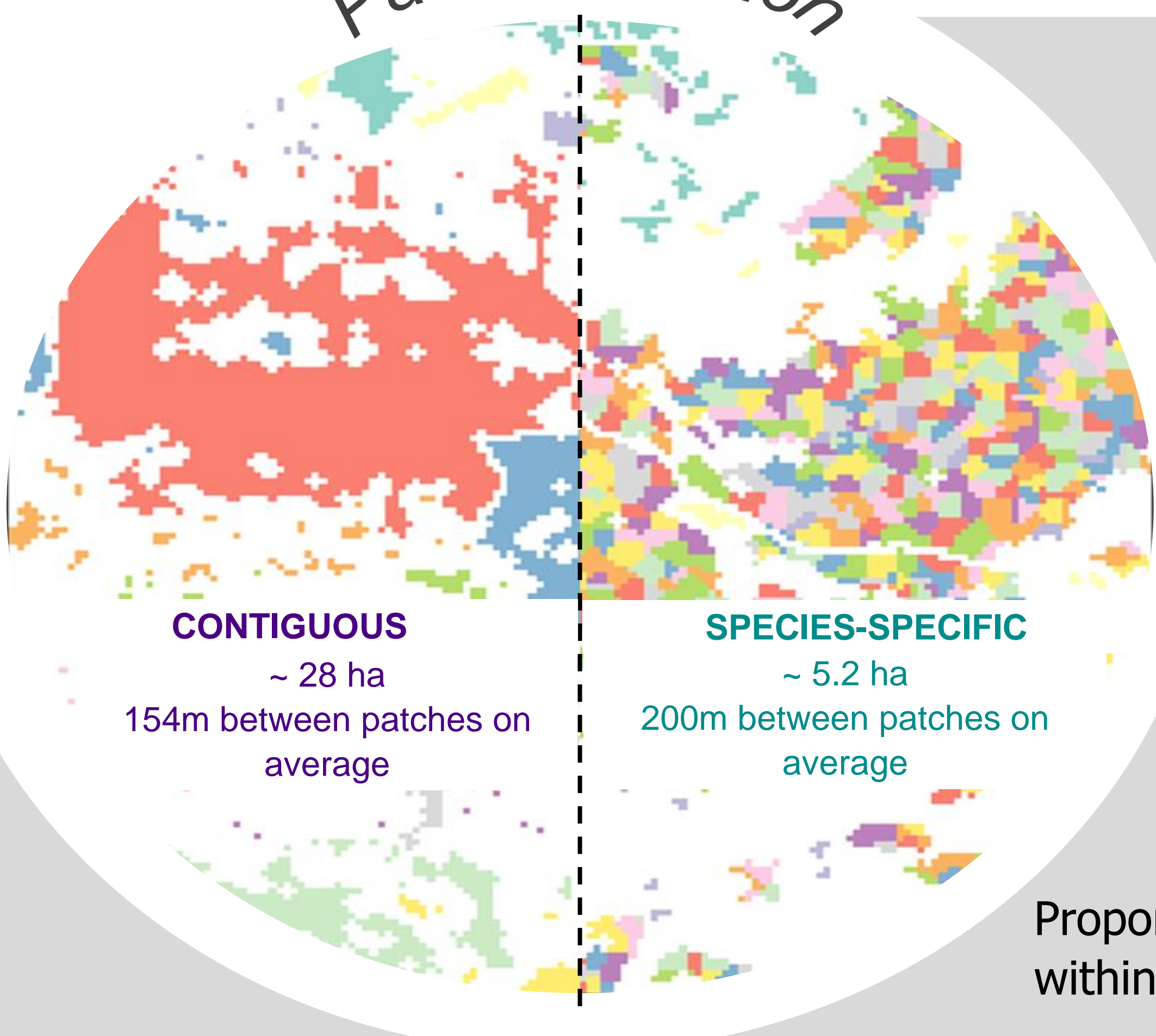
- random point sampling + Voronoi tessellation
- To get patch size close to red squirrel home range size

Principle of tessellation and patch cutting on a part of the map



### 3 Results

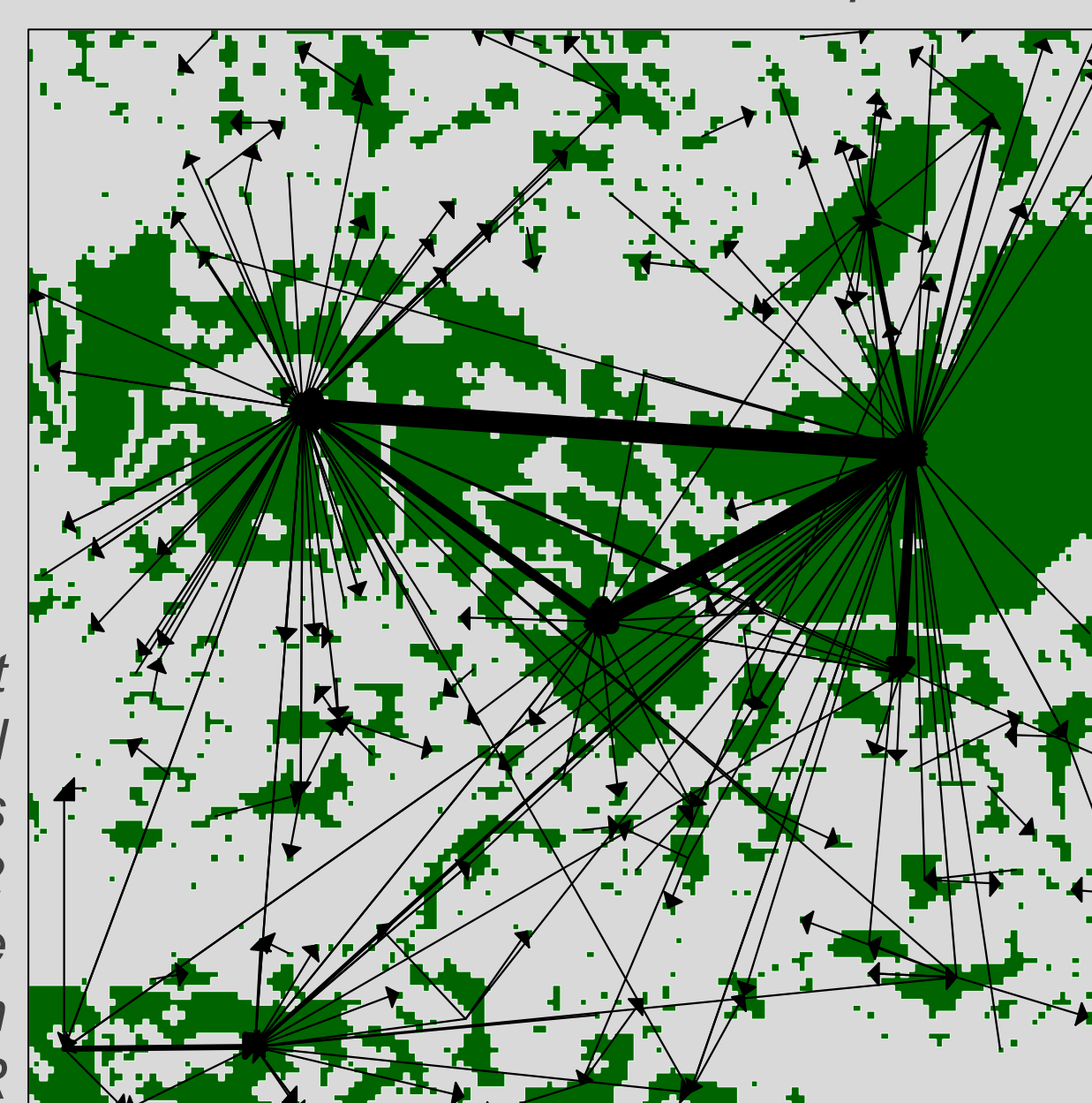
patch definition



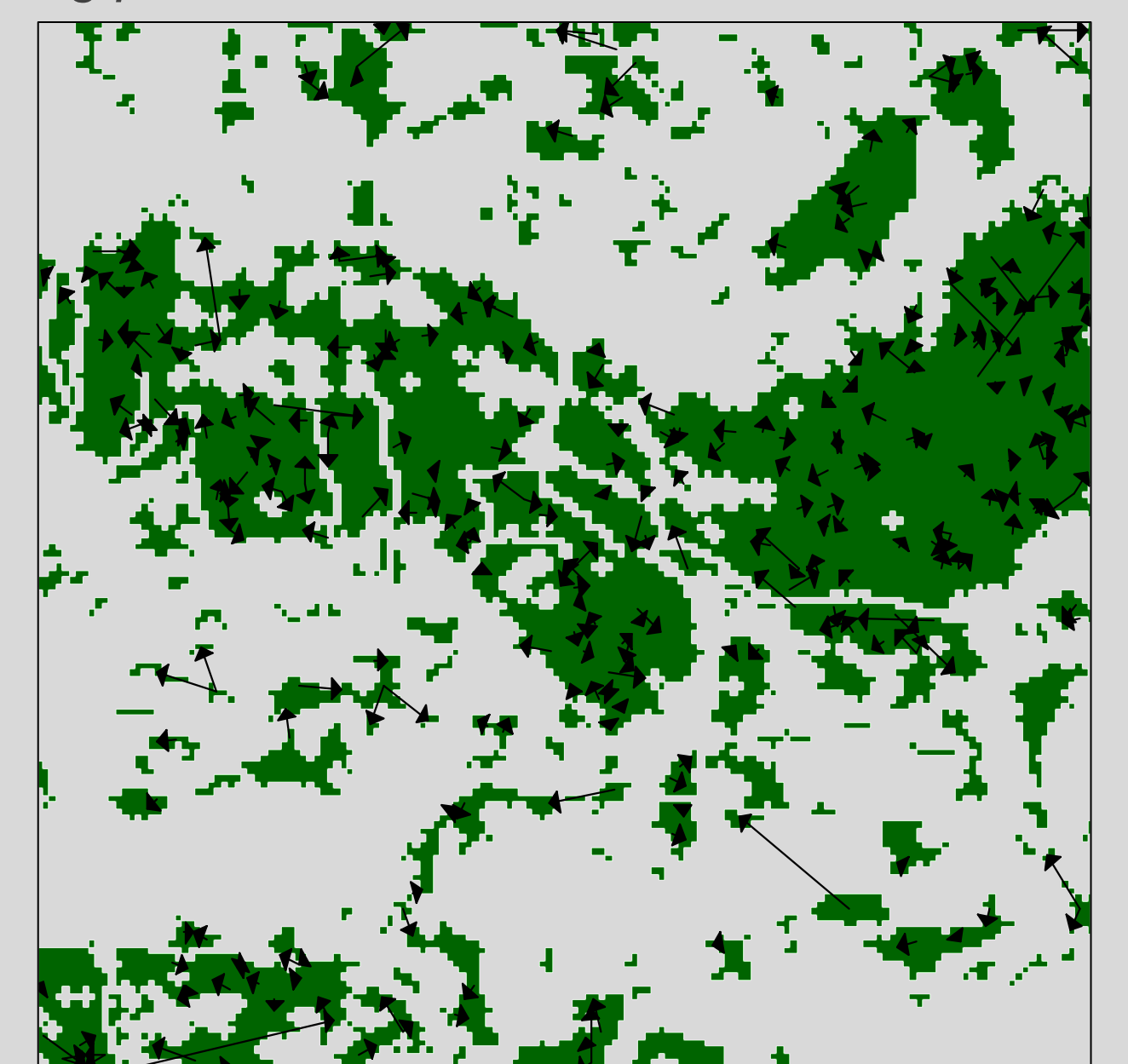
#### Squirrel dispersal

Dispersal network among patches

The arrows represent the main dispersal events (i.e. events concerning at least 2 individuals) the entire simulation with RangeShiftR



Contiguous patches



Species-specific patches

#### Patch size comparison

% of patches with an area within the range of a squirrel's home range size:

Contiguous patches: **28%**

vs

Species-specific patches: **82%**

Proportion of dispersal events within contiguous habitat

**0 %**

**73.7%**  
(± 0.67%)

Dispersal success

**52.5%**  
(± 0.6%)

**76.2 %**  
(± 4.1%)

Mean dispersal distance

**4192.6m**  
(± 72.2m)

**1228.1m**  
(± 34.1m)

In the literature, usual dispersal distance is about 700-1500m, 1000m on average

→ When patch area is closer to squirrel home range size, simulated dispersal is more realistic in terms of destination and distances, and more successful

### 4 Conclusions

With patch areas closer to squirrel home range size:

- RESULT 1:** Dispersal events within contiguous habitat are now spatially explicit
- RESULT 2:** Mean dispersal distance is closer to literature data
- PERSPECTIVES:** Investigate **consequences** on **genetic outputs**



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#### References

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- Bocedi G, Palmer SCF, Malchow AK, Zurell D, Watts K, Travis JMJ (2020) RangeShifter 2.0: An extended and enhanced platform for modelling spatial eco-evolutionary dynamics and species' responses to environmental changes. *bioRxiv* 2020.11.26.400119. <https://doi.org/10.1101/2020.11.26.400119>