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► **To cite this version:**

Mailys Queru, Cécile H. Albert, Aurélie Coulon. What is a patch?. International Congress in Ecology & Evolution (SFE2), Lyon 2024, Oct 2024, Lyon, France. , 2024. hal-04871040

HAL Id: hal-04871040

<https://amu.hal.science/hal-04871040v1>

Submitted on 7 Jan 2025

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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)

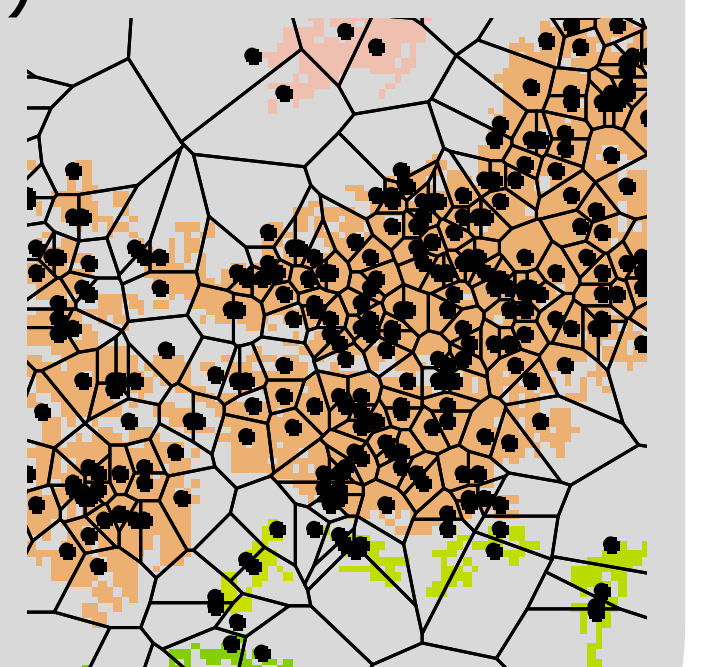
Study area

- 16x16 km area in southern France, Alpilles mountains

Patch cutting

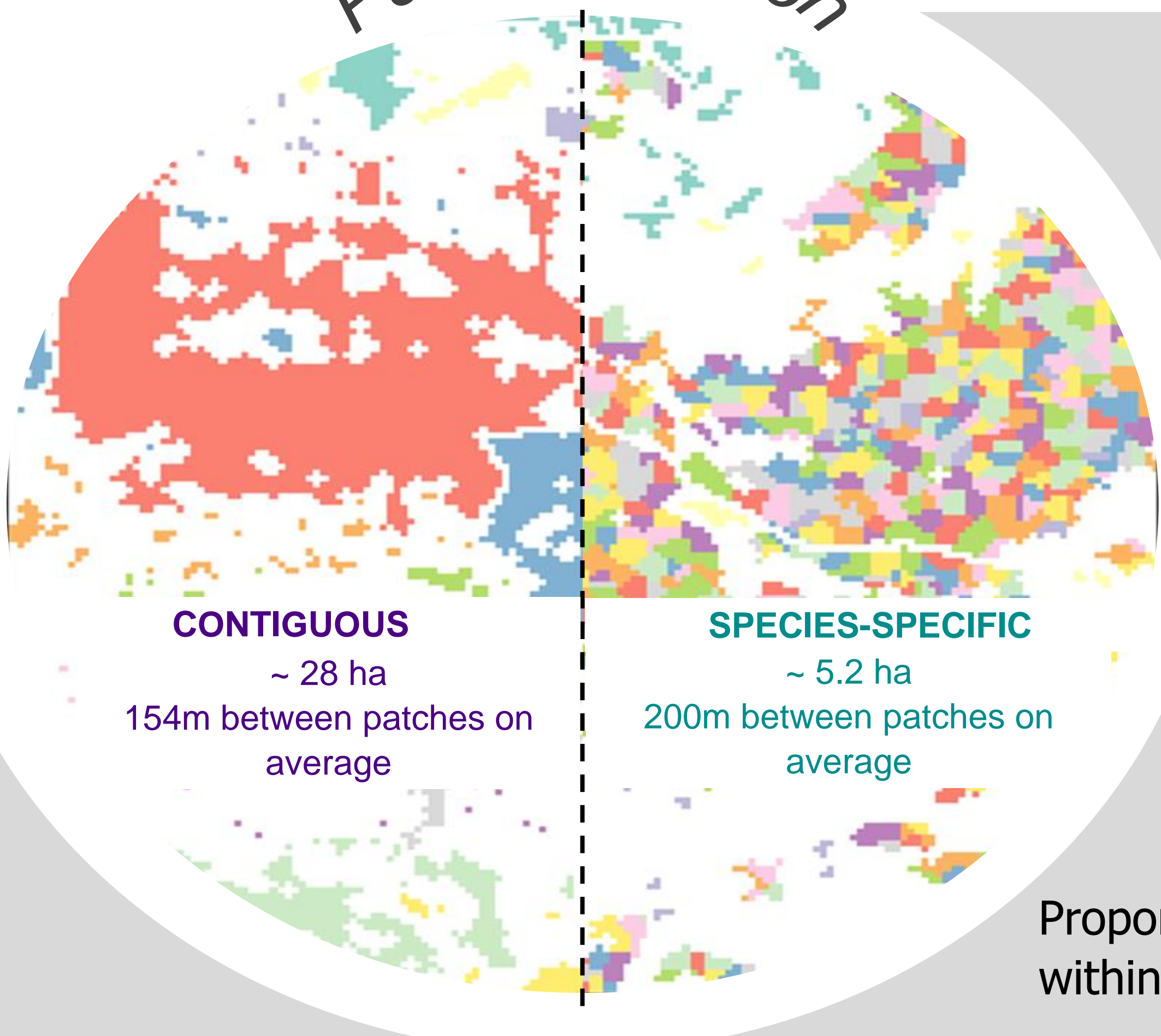
- random point sampling + Voronoi tessellation
- To get patch size close to red squirrel home range size

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



3 Results

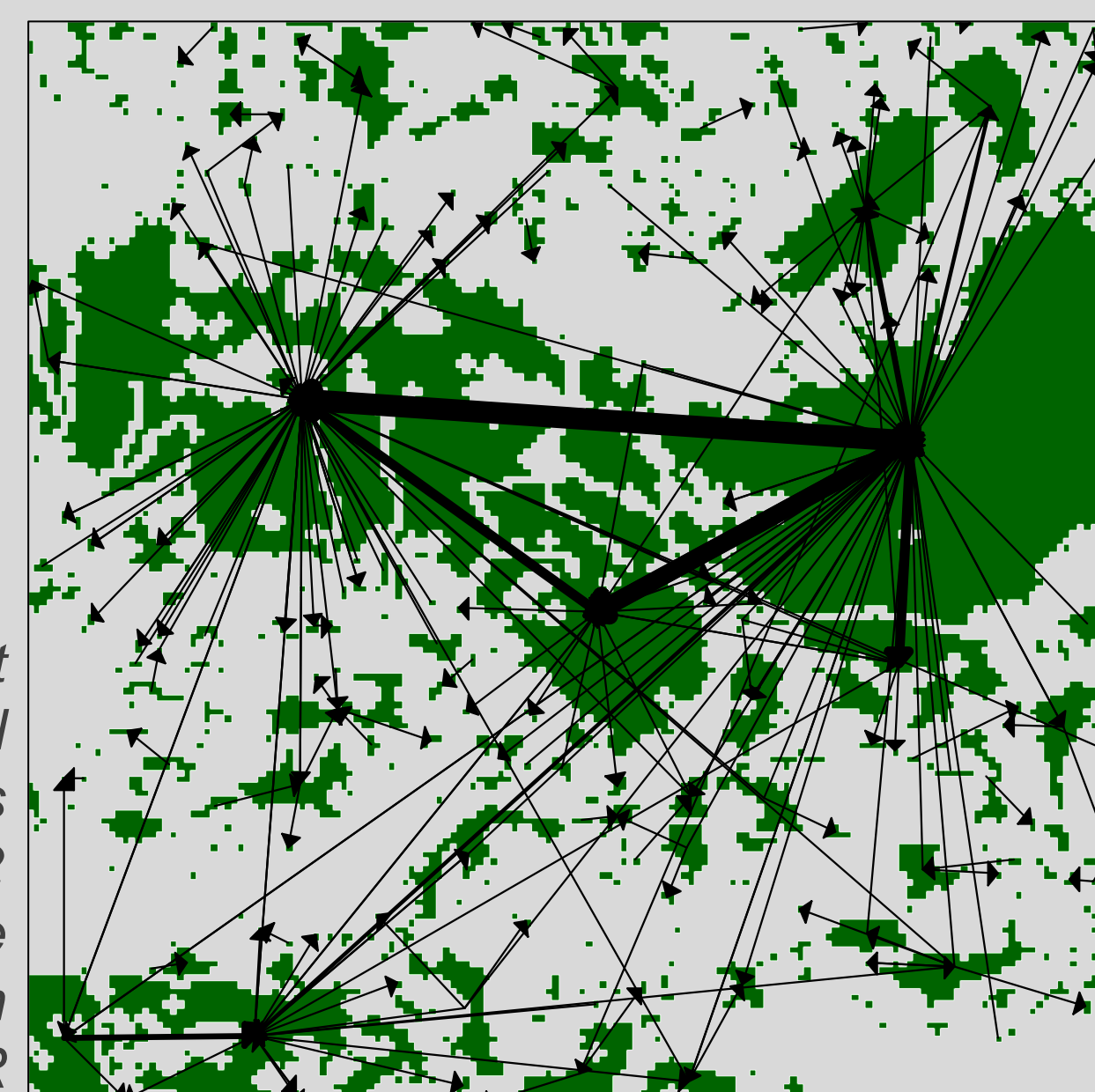
patch definition



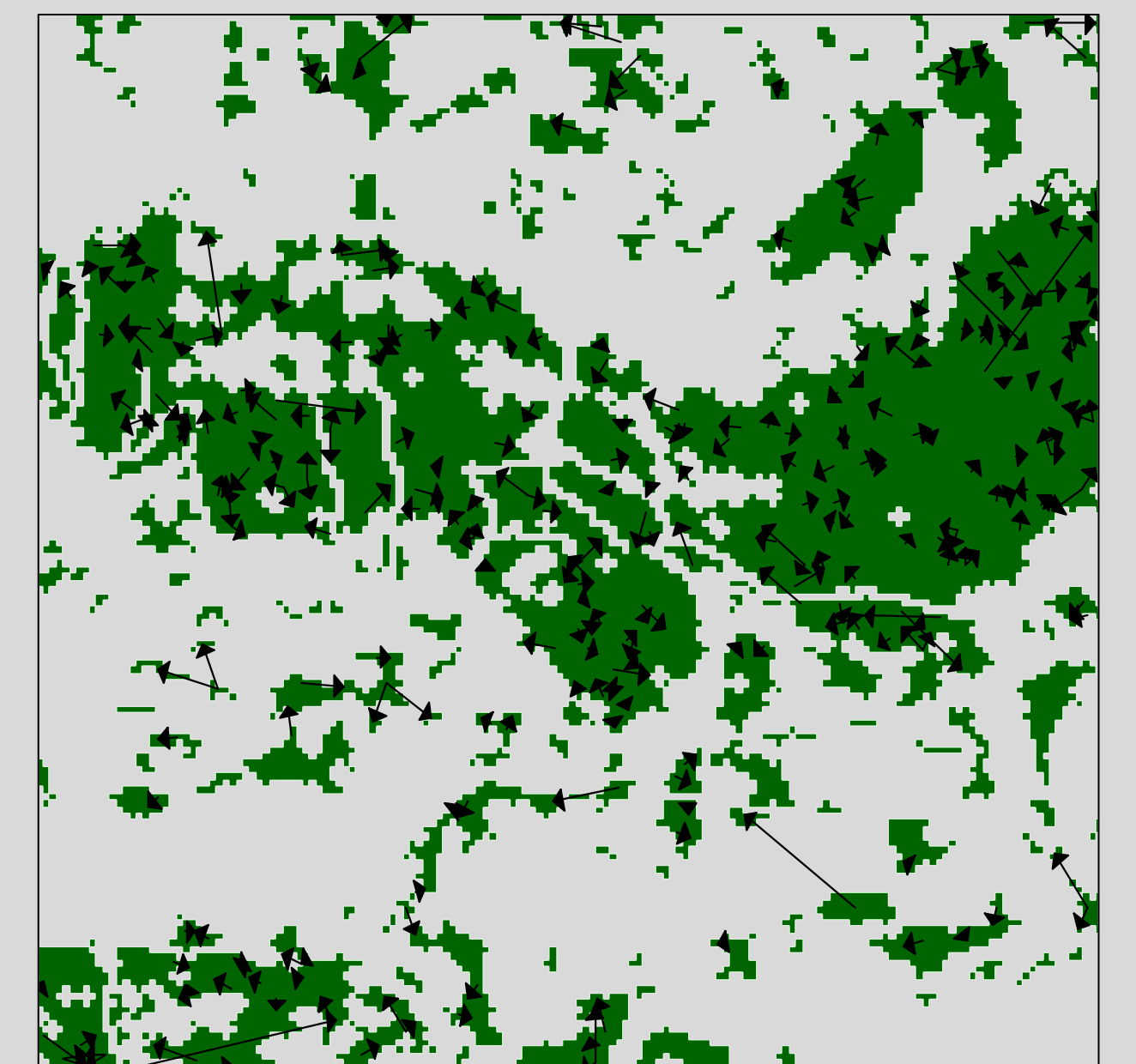
Squirrel dispersal

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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