# Spatially explicit populations models to deal with issues in IAS management

Giovanni Vimercati – Post-doc at University of Angers

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1) When can we manage it?

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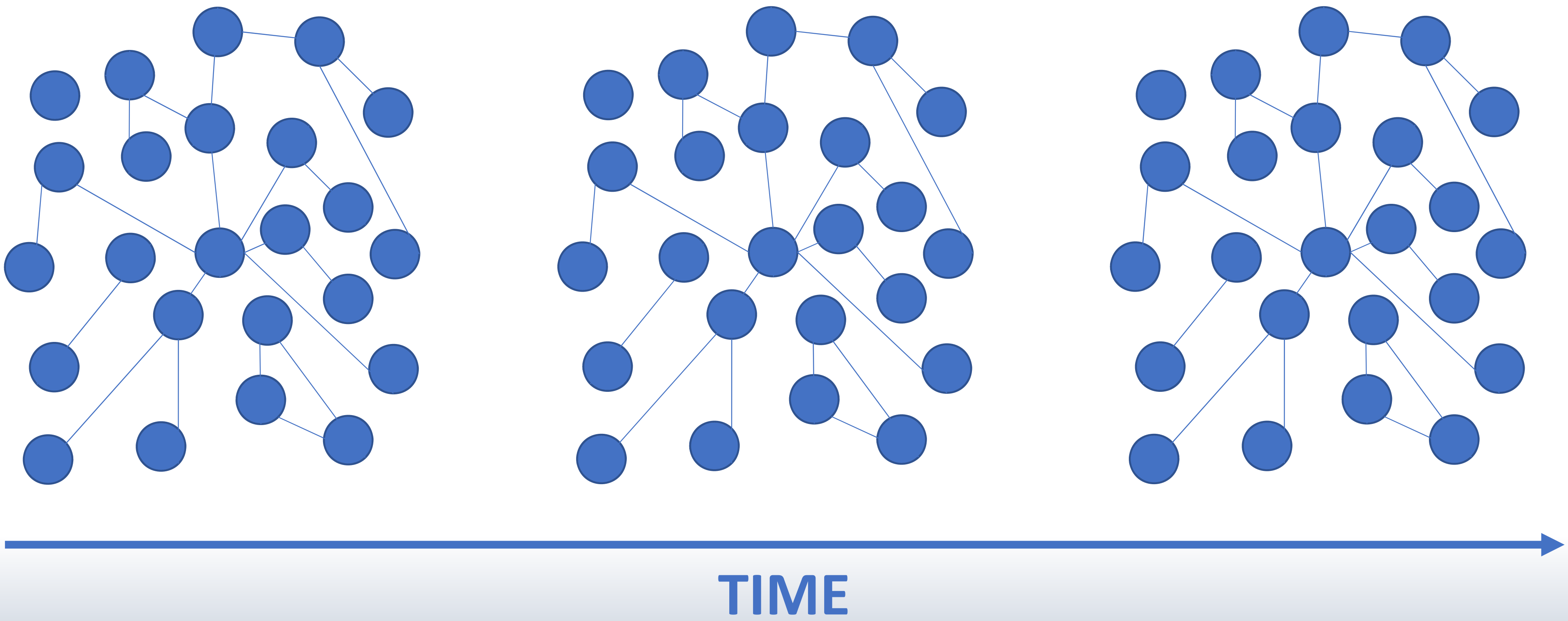

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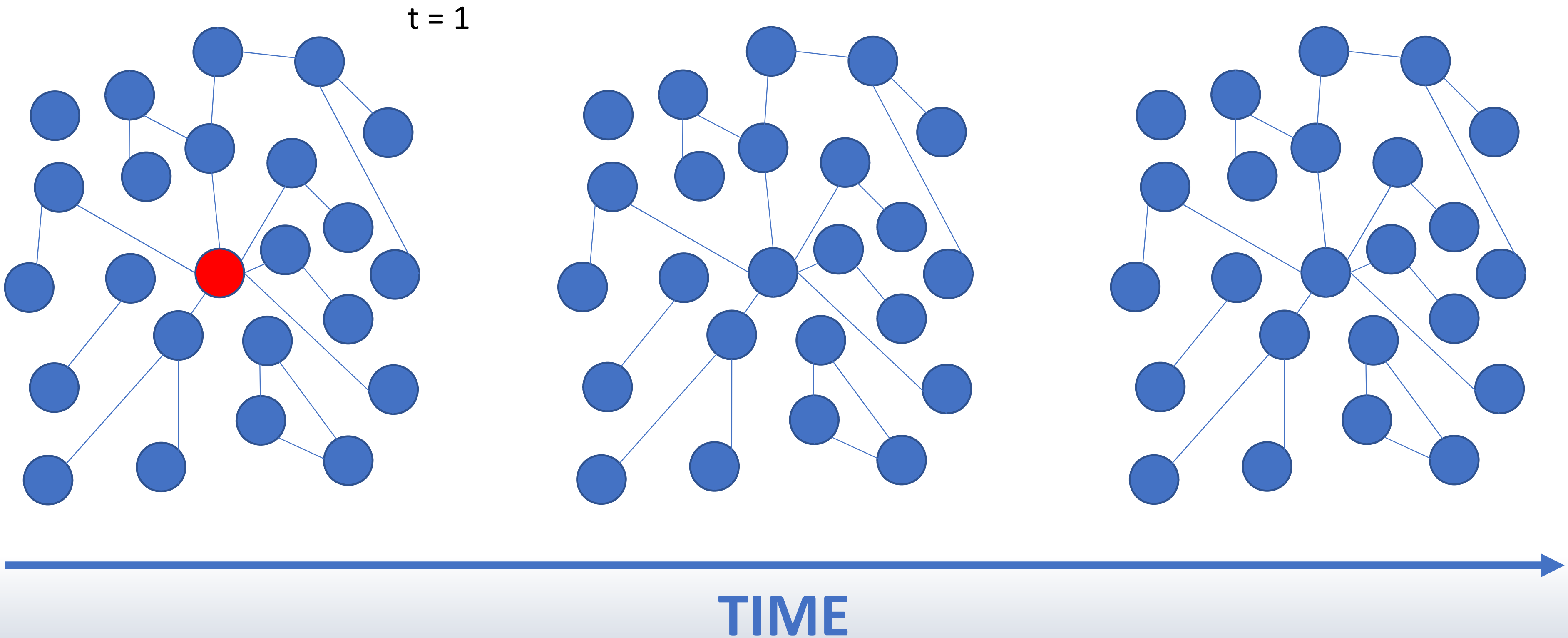

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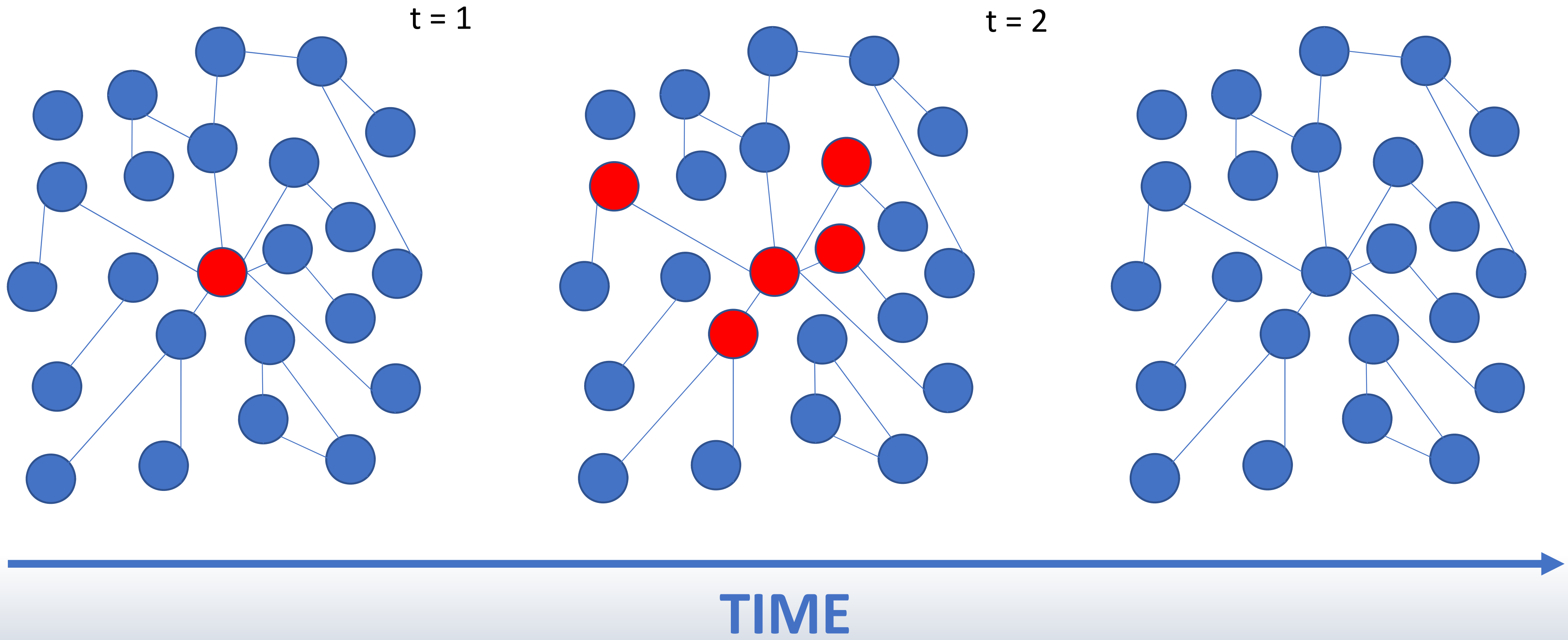

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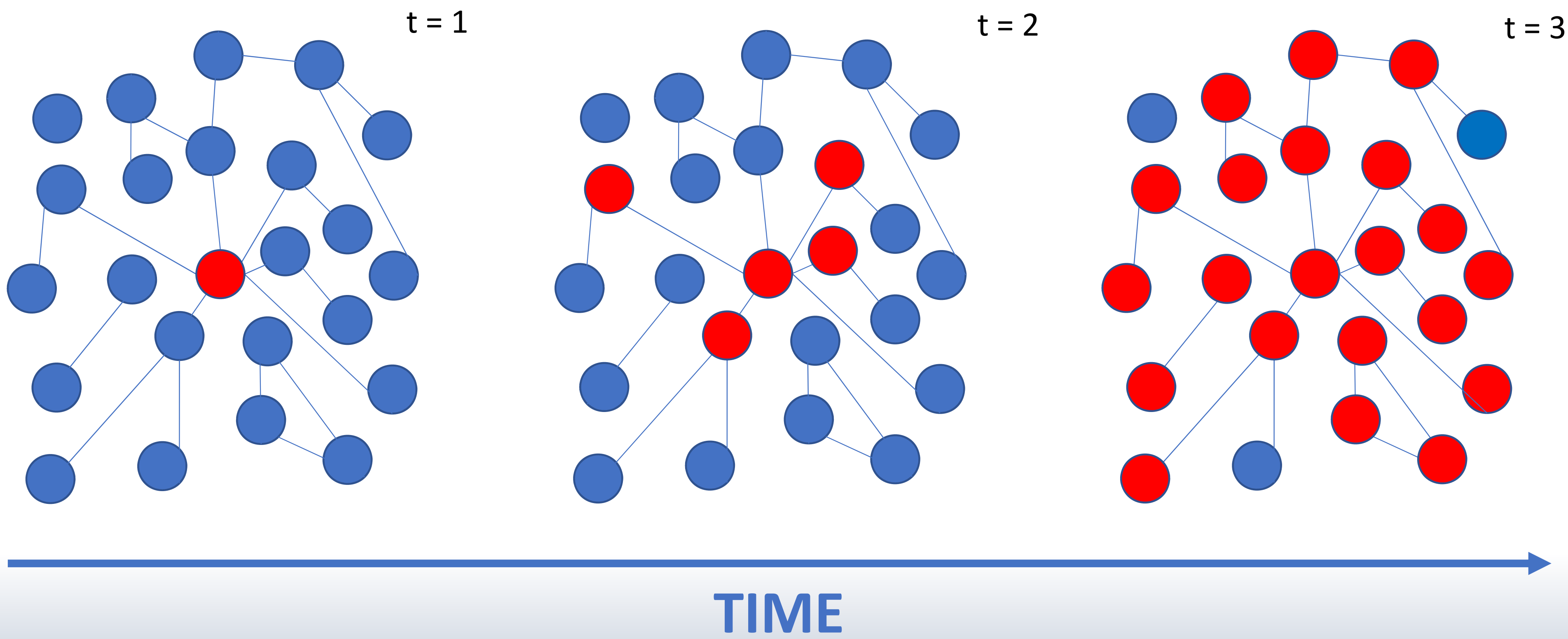

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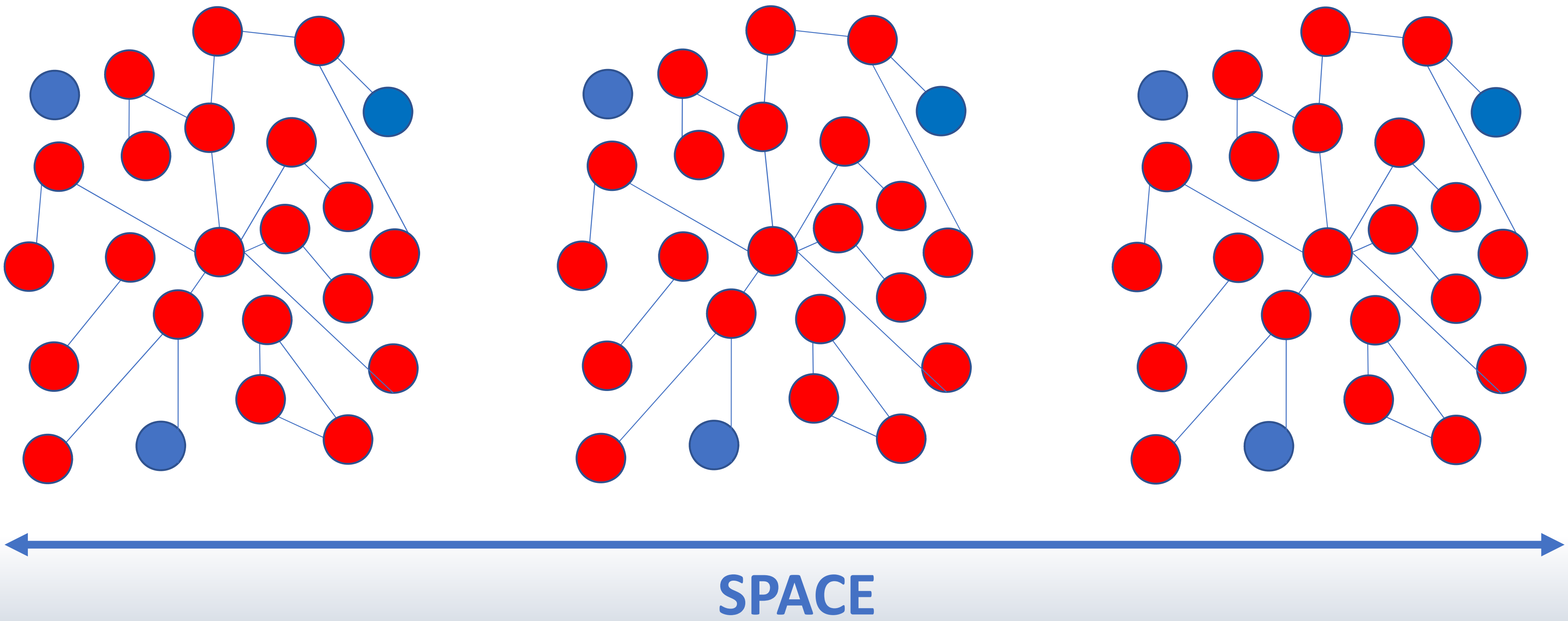

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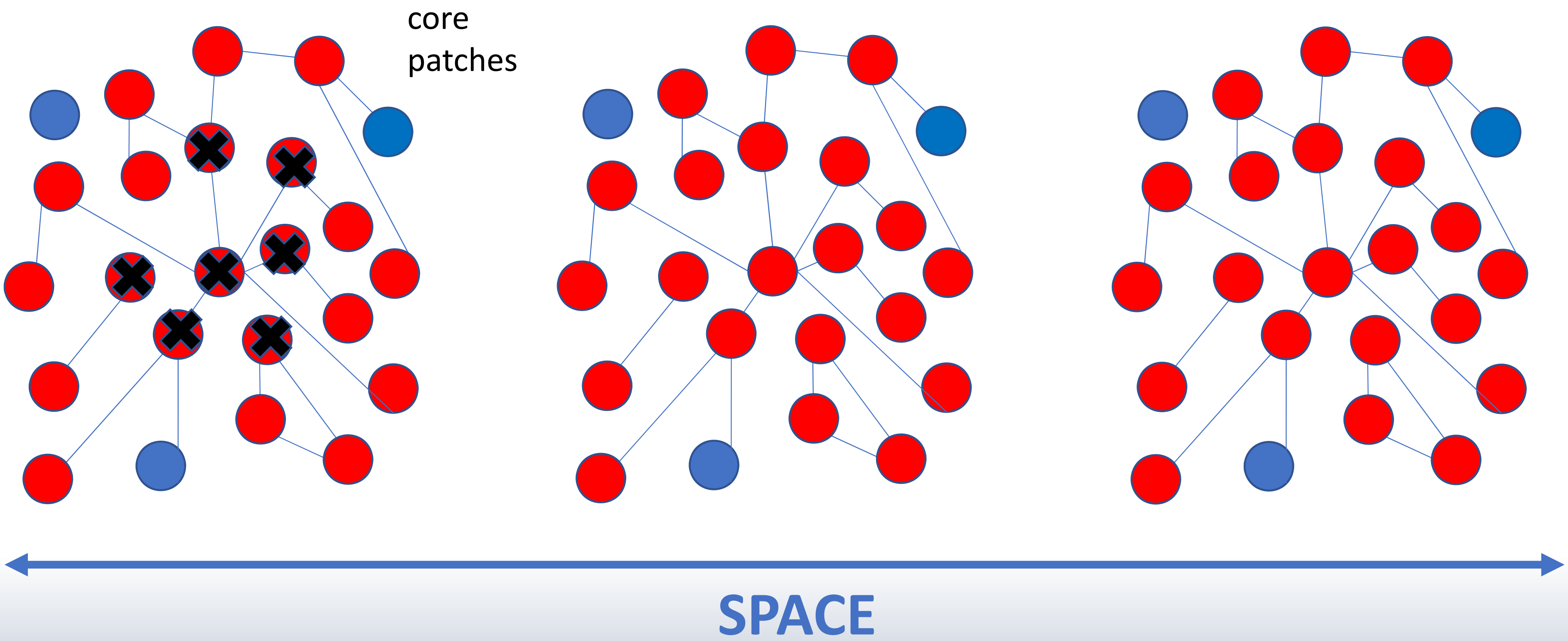

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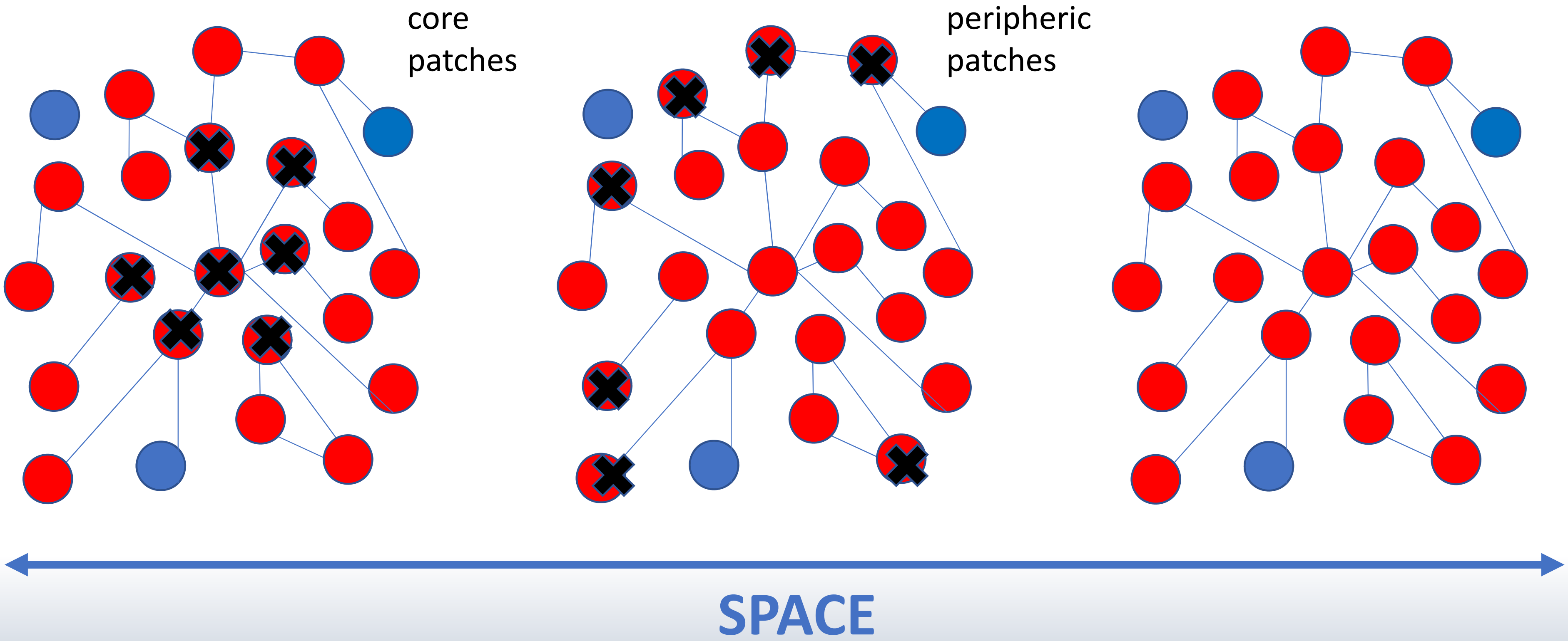

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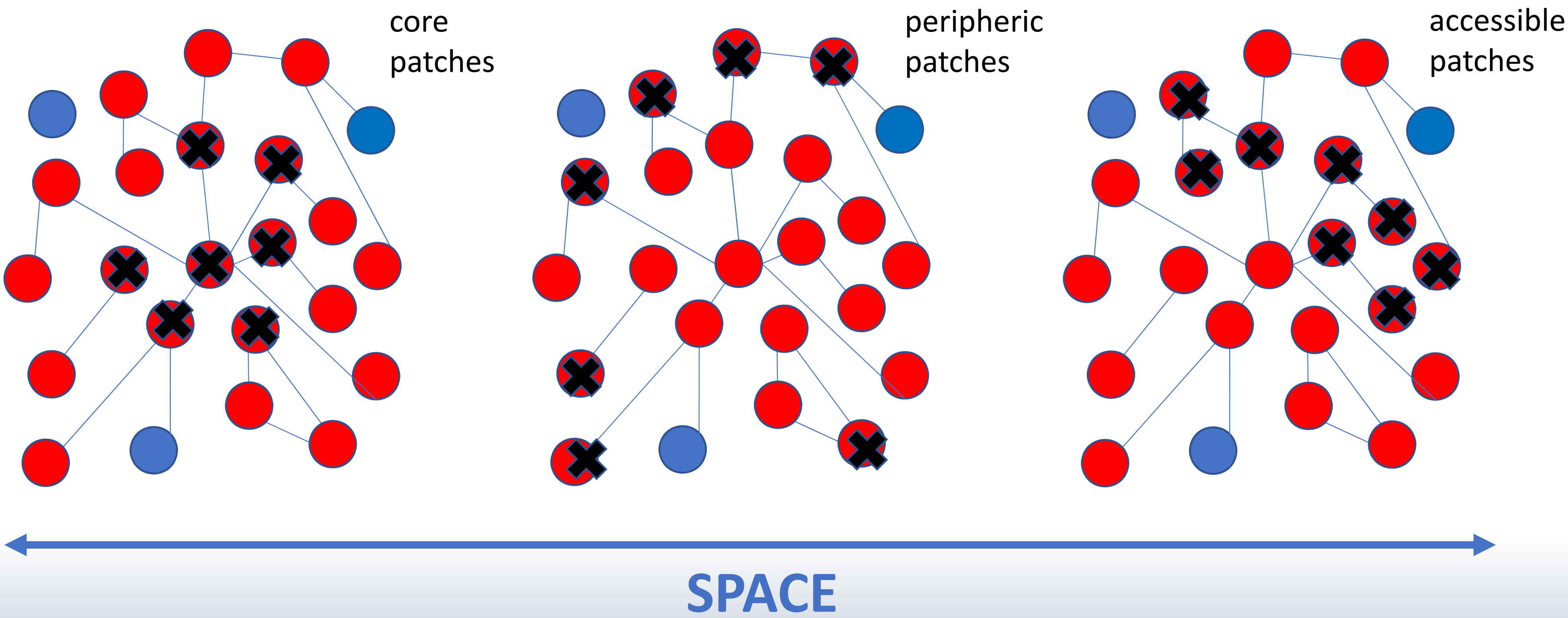

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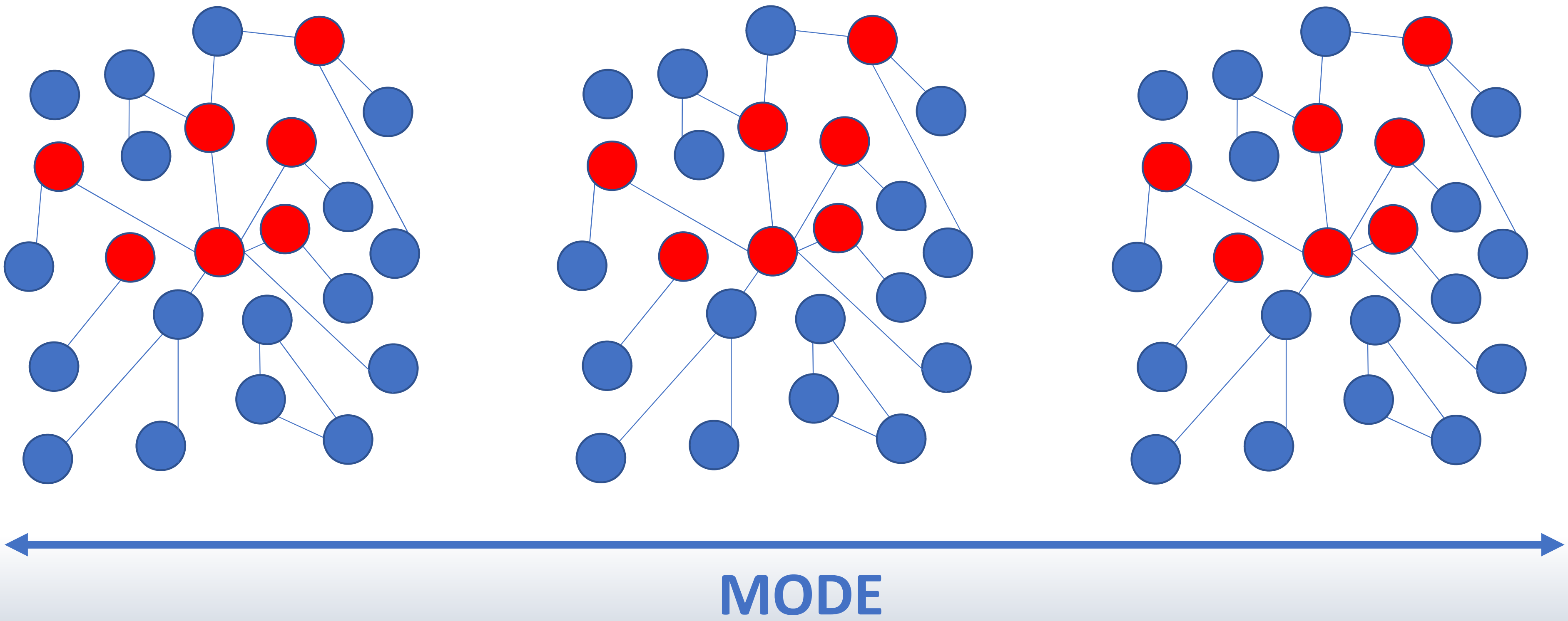

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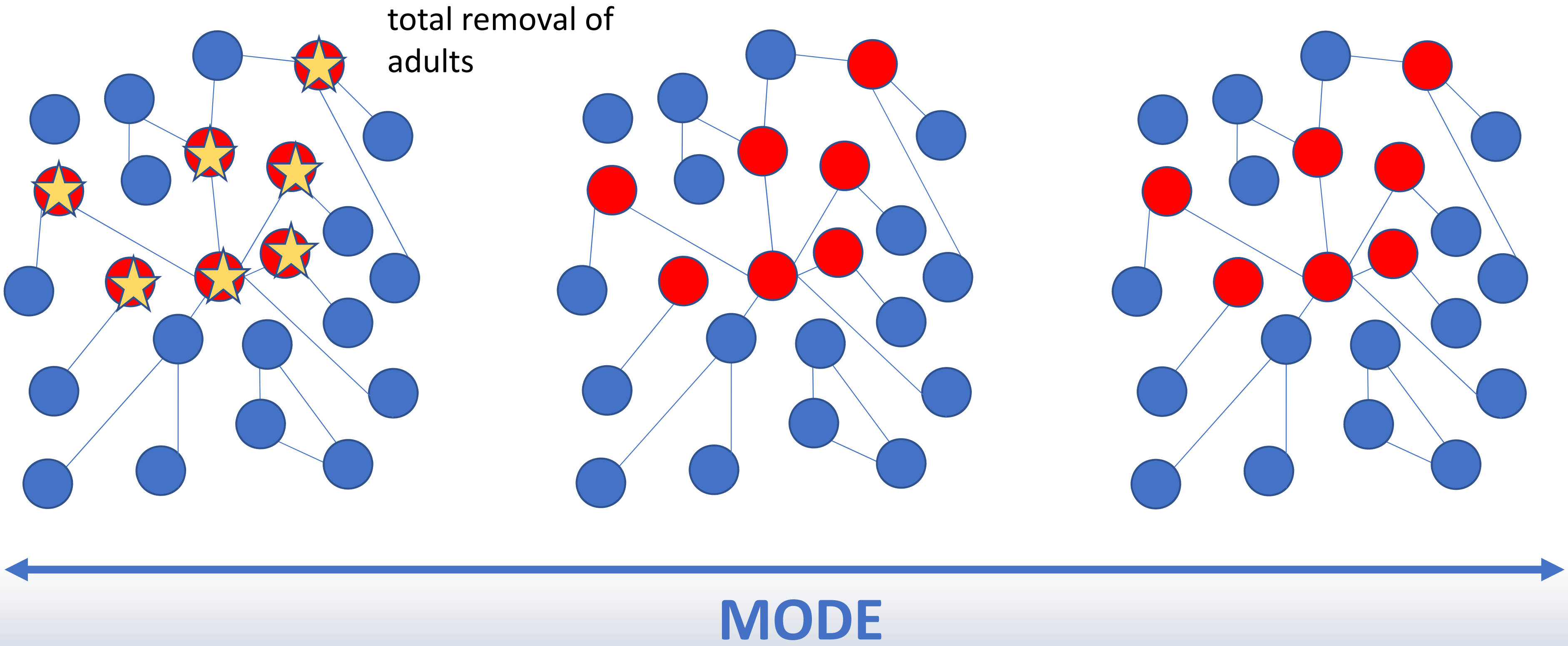

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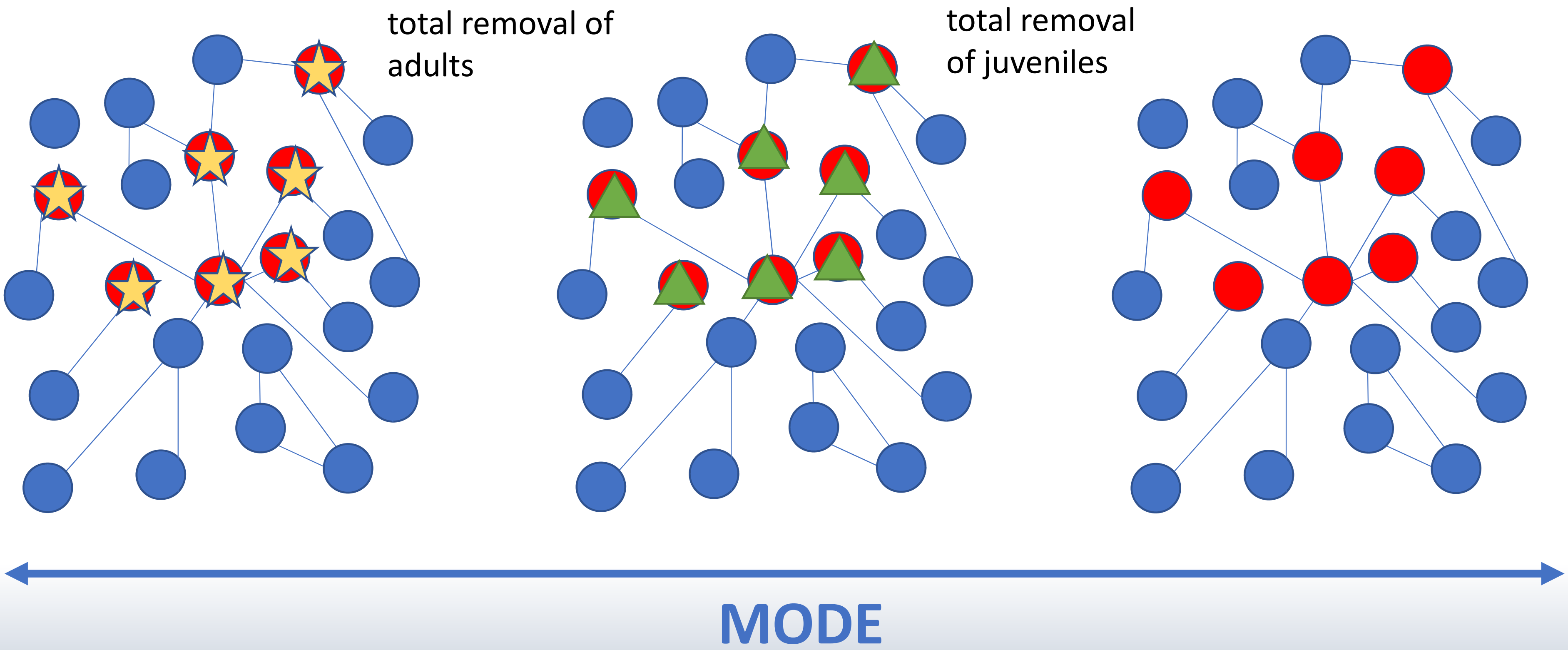

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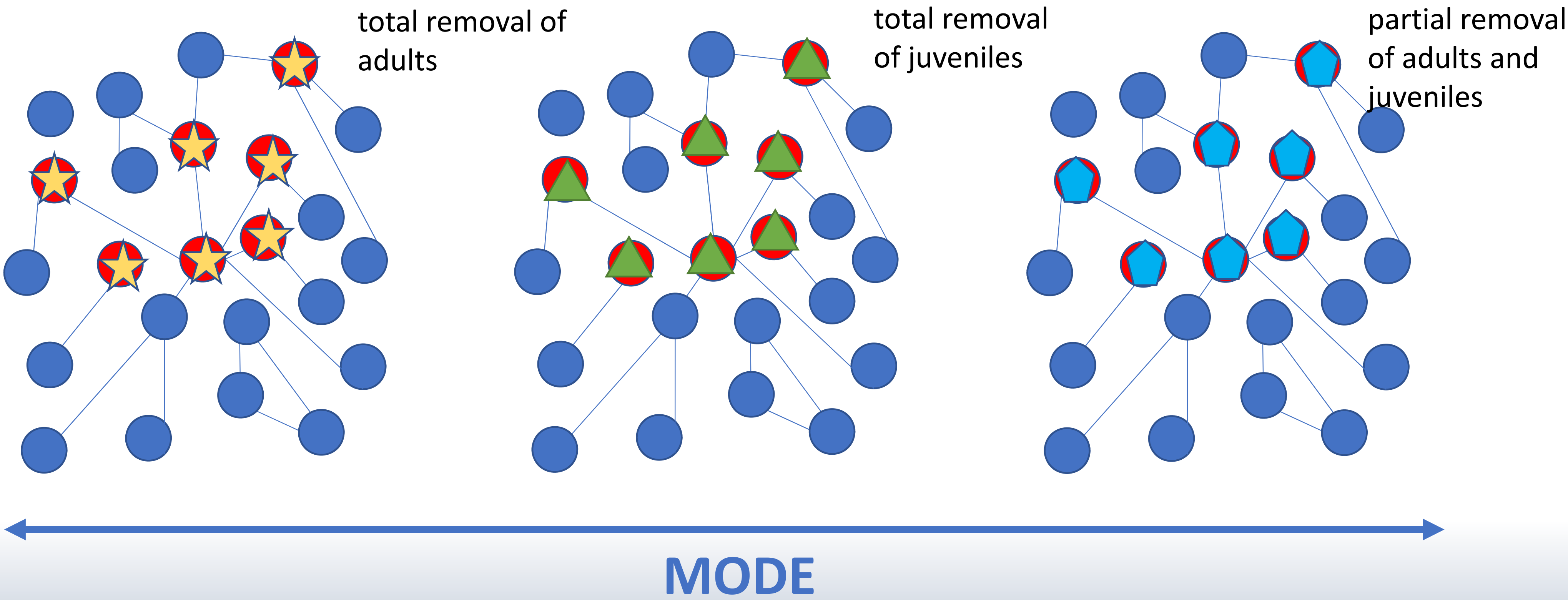

Non-equilibrium spatio-temporal dinamics of invasive species

# Invasion science for society: A decade of contributions from the Centre for Invasion Biology

AUTHORS:
Brian W. van Wilgen[1]
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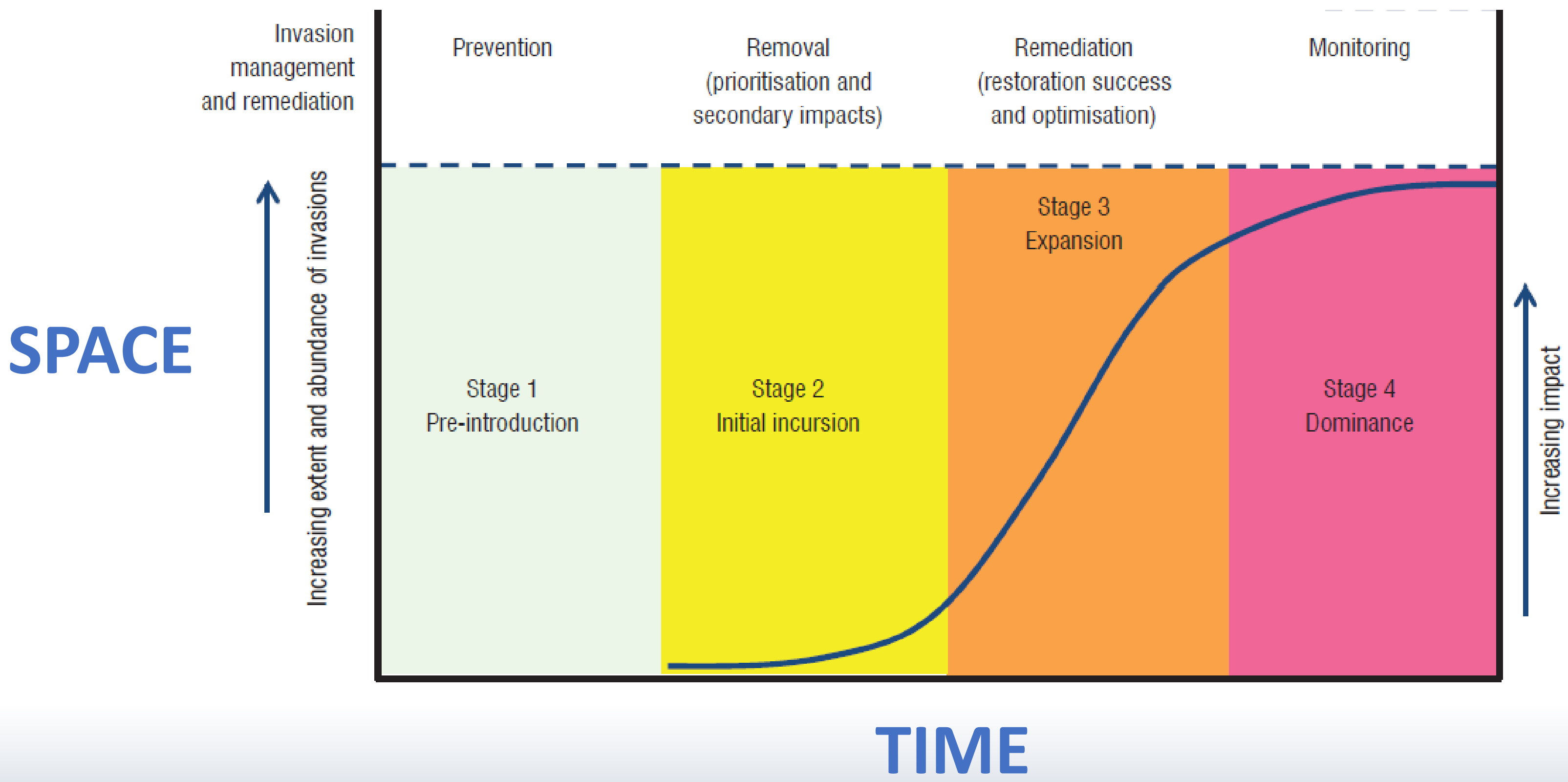
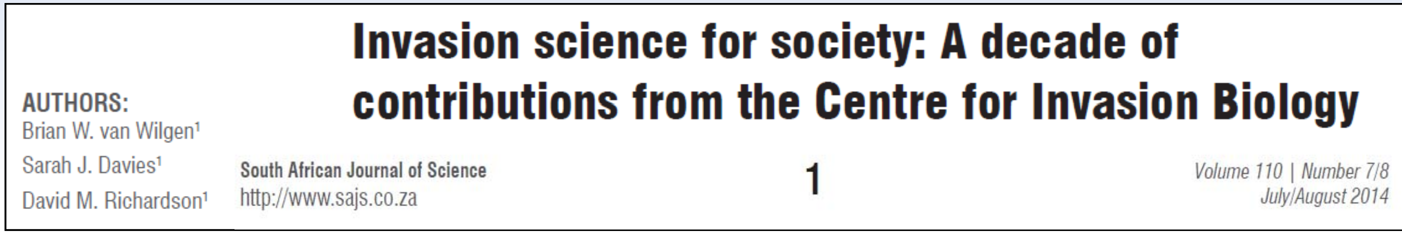


Non-equilibrium spatio-temporal dinamics of invasive species

Can be reconstructed using **spatially explicit** population models:

- cellular automata and lattice models
- metapopulation, gravity and network models
- individual based models



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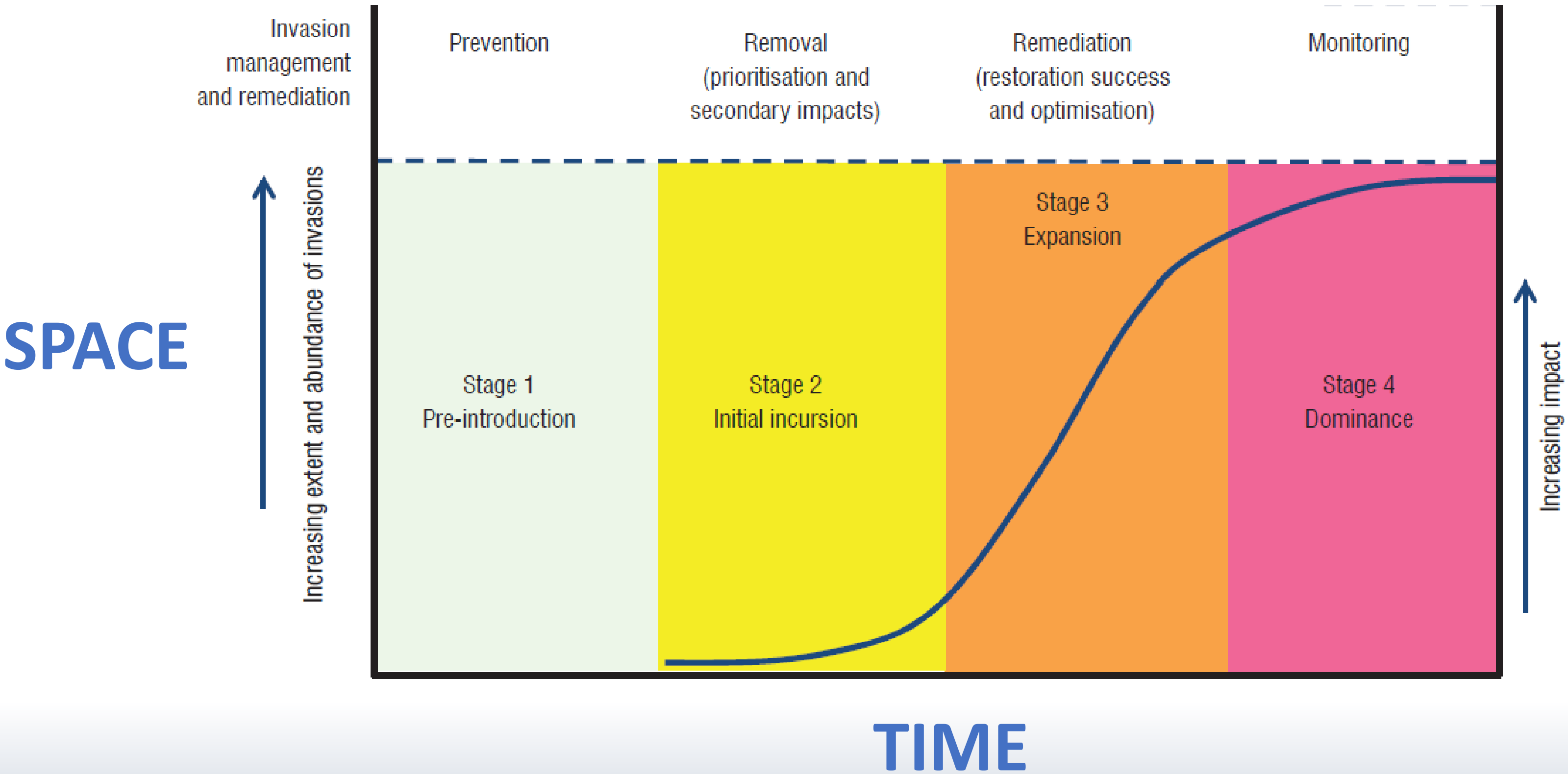

Cellular automata and lattice models: the space is subdivided in discrete cells

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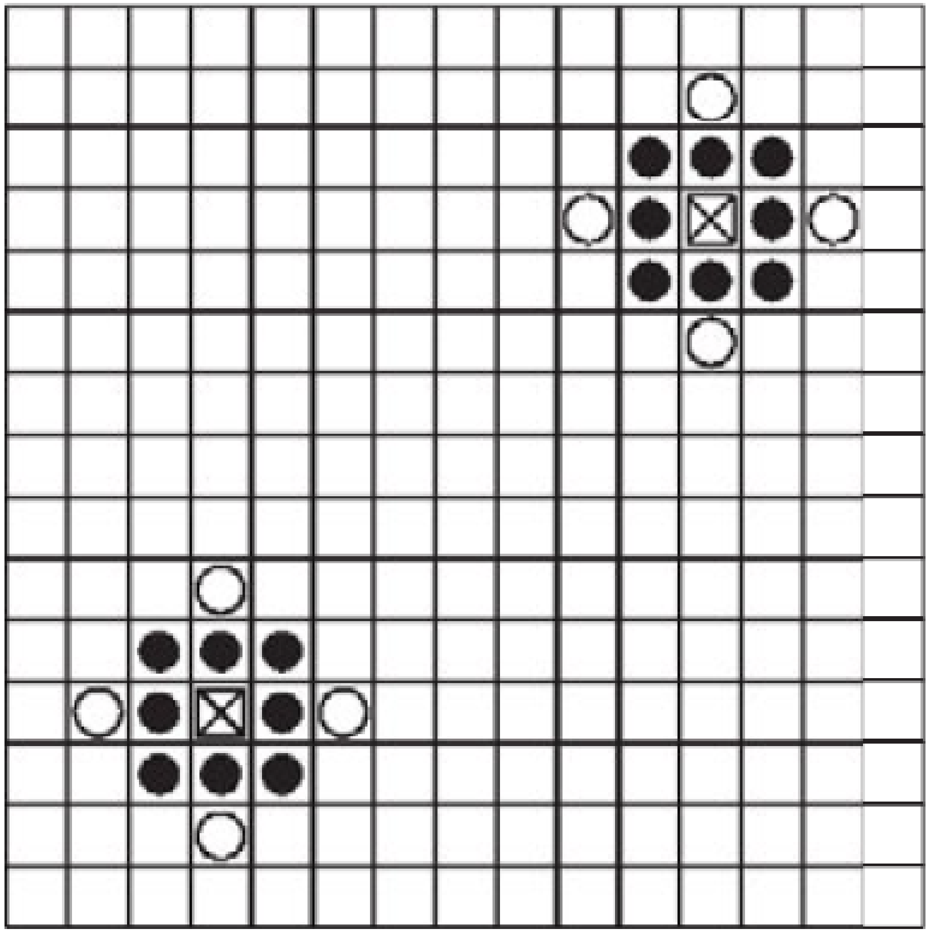

NATURAL RESOURCE MODELING
Volume 30, Number 2, May 2017

**INTEGER PROGRAMMING APPROACH TO CONTROL INVASIVE SPECIES SPREAD BASED ON CELLULAR AUTOMATON MODEL**

ATSUSHI YOSHIMOTO

■ Colonized cells without treatments

● Newly colonized cells

⊠ Colonized cells with treatments

○ Uncolonized cells with treatments

□ Uncolonized cells

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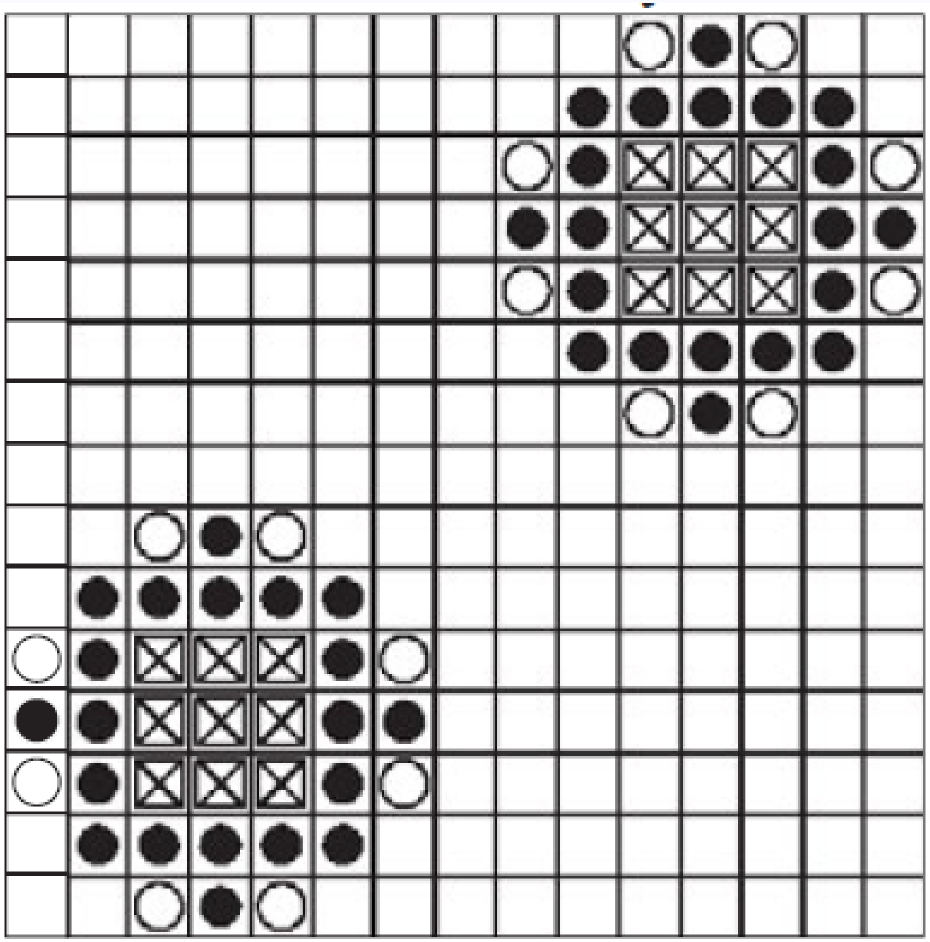

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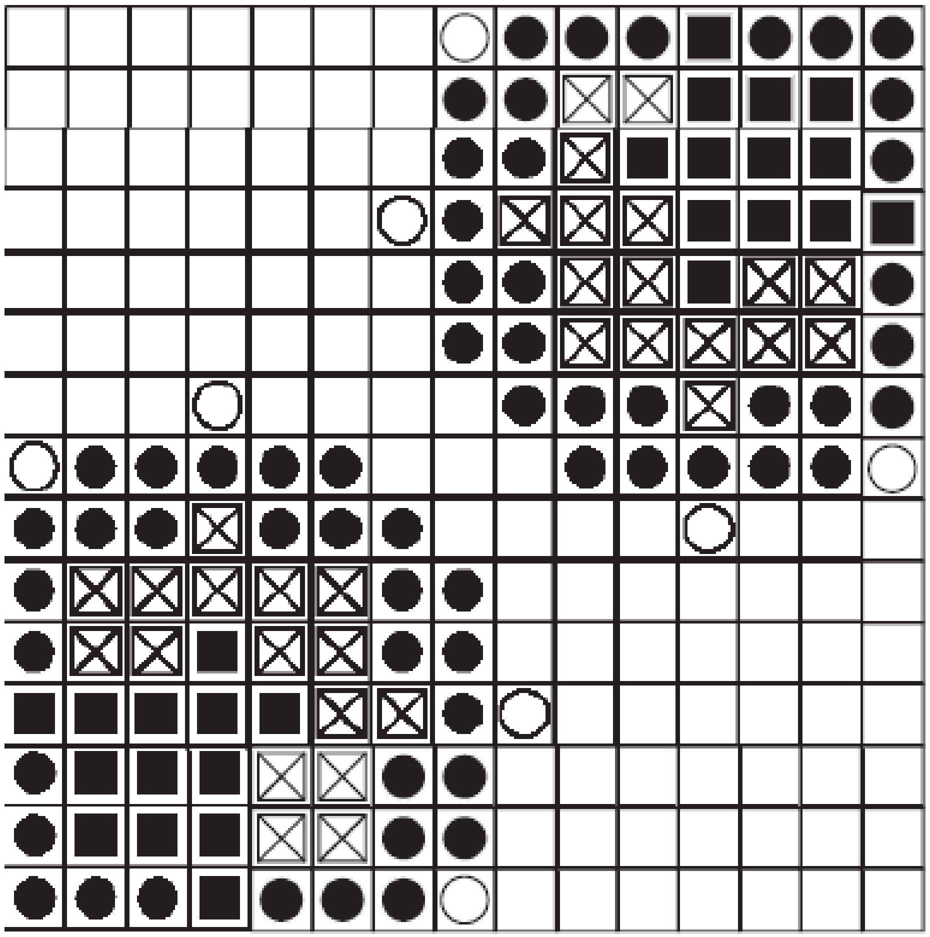

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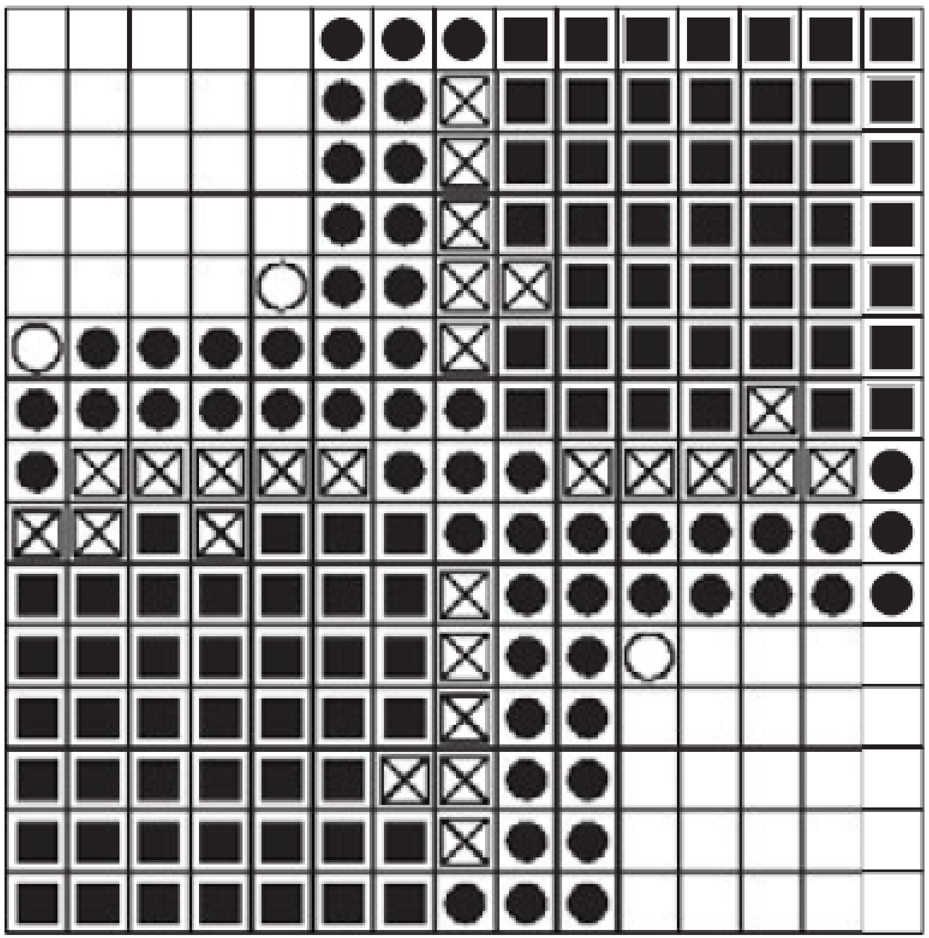

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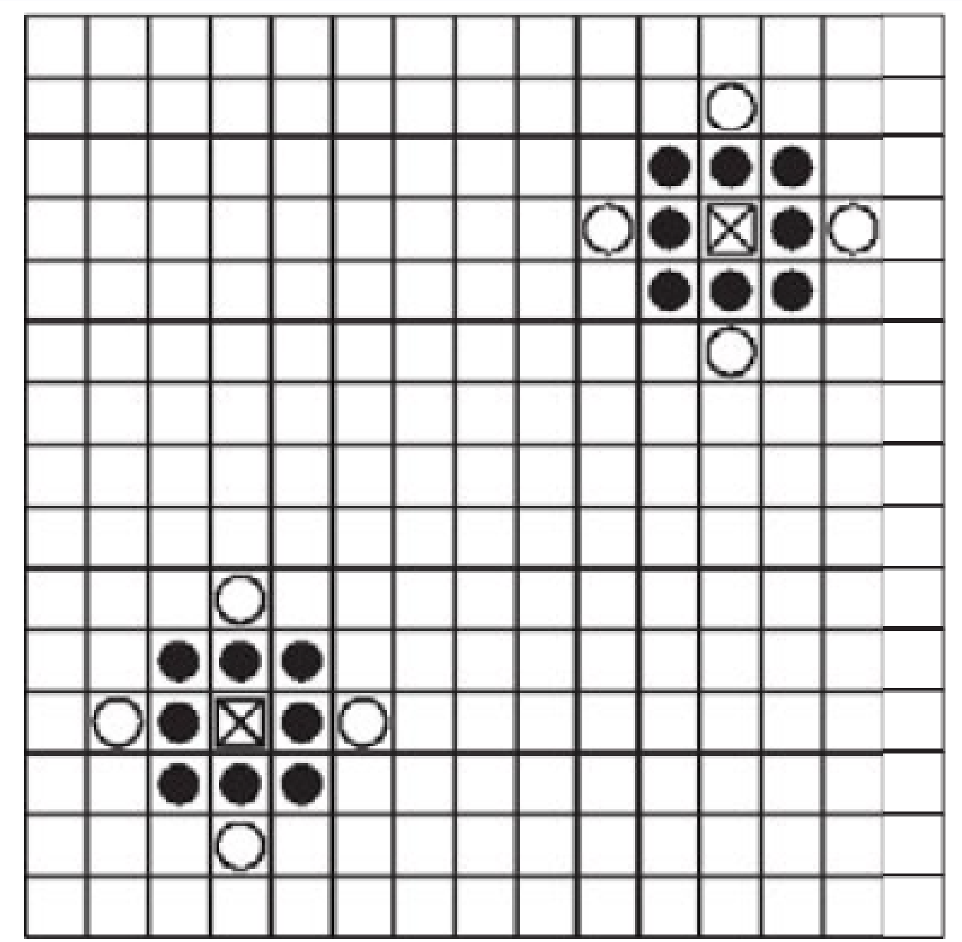

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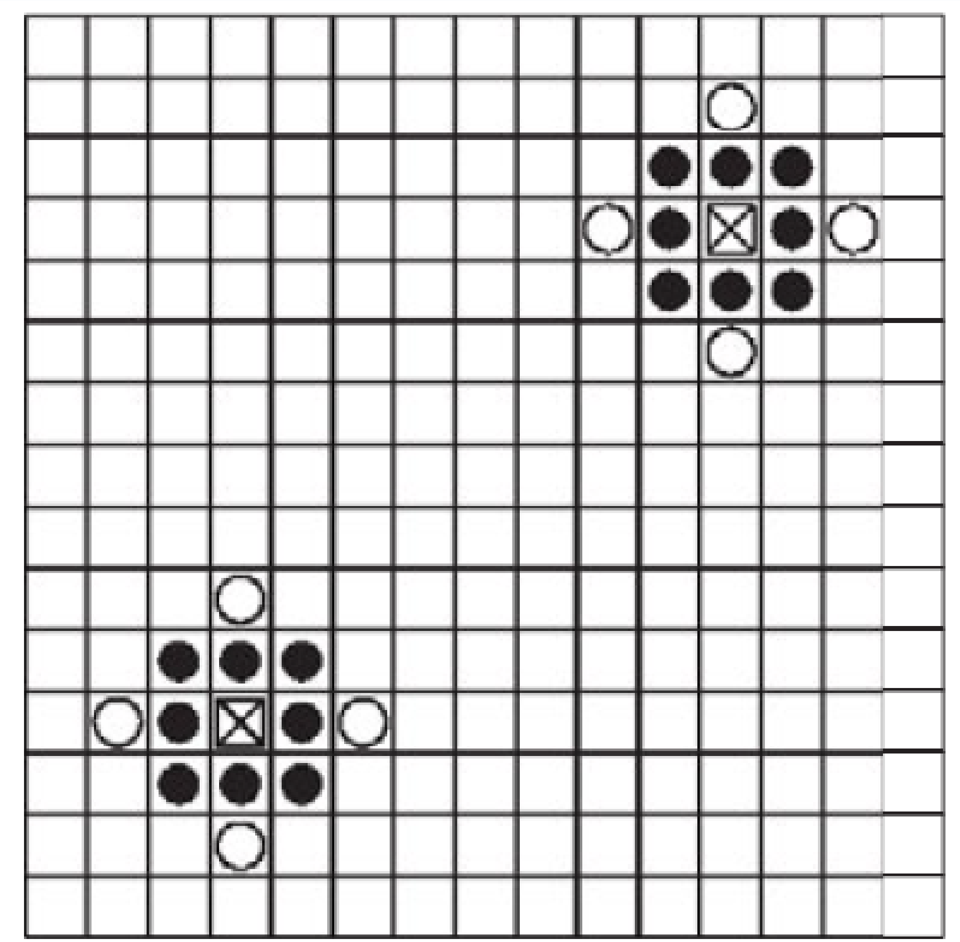

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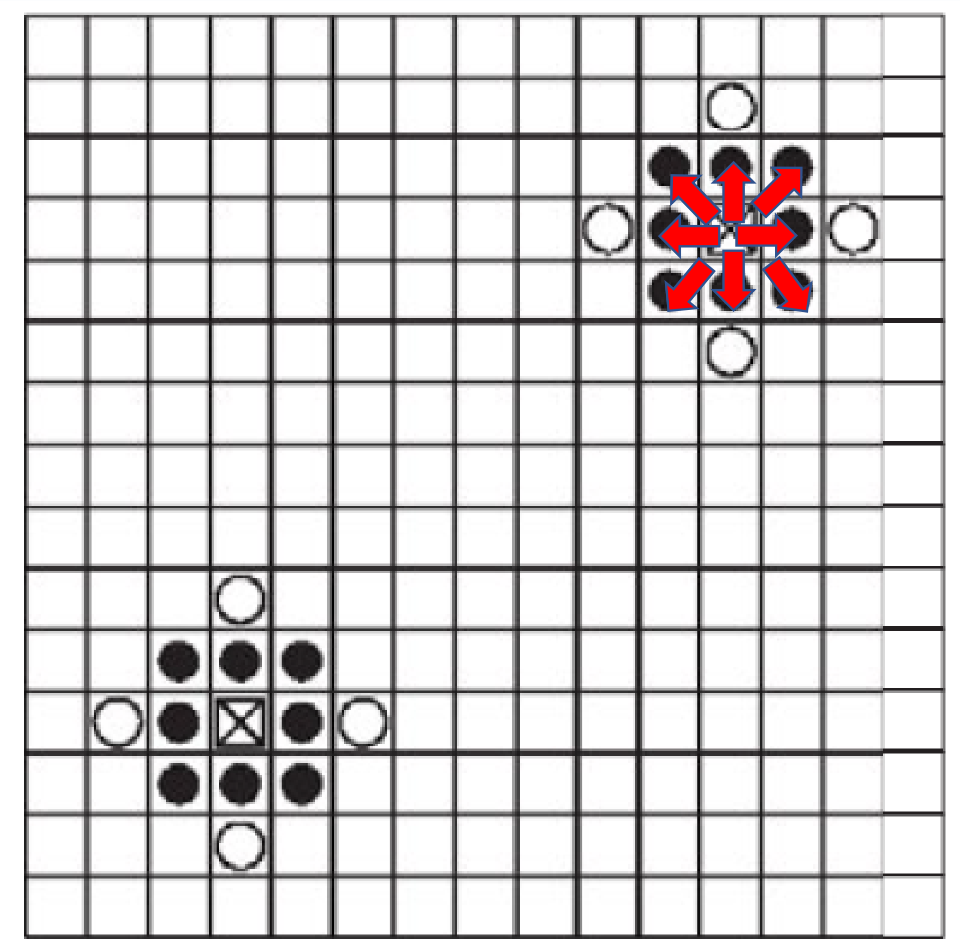

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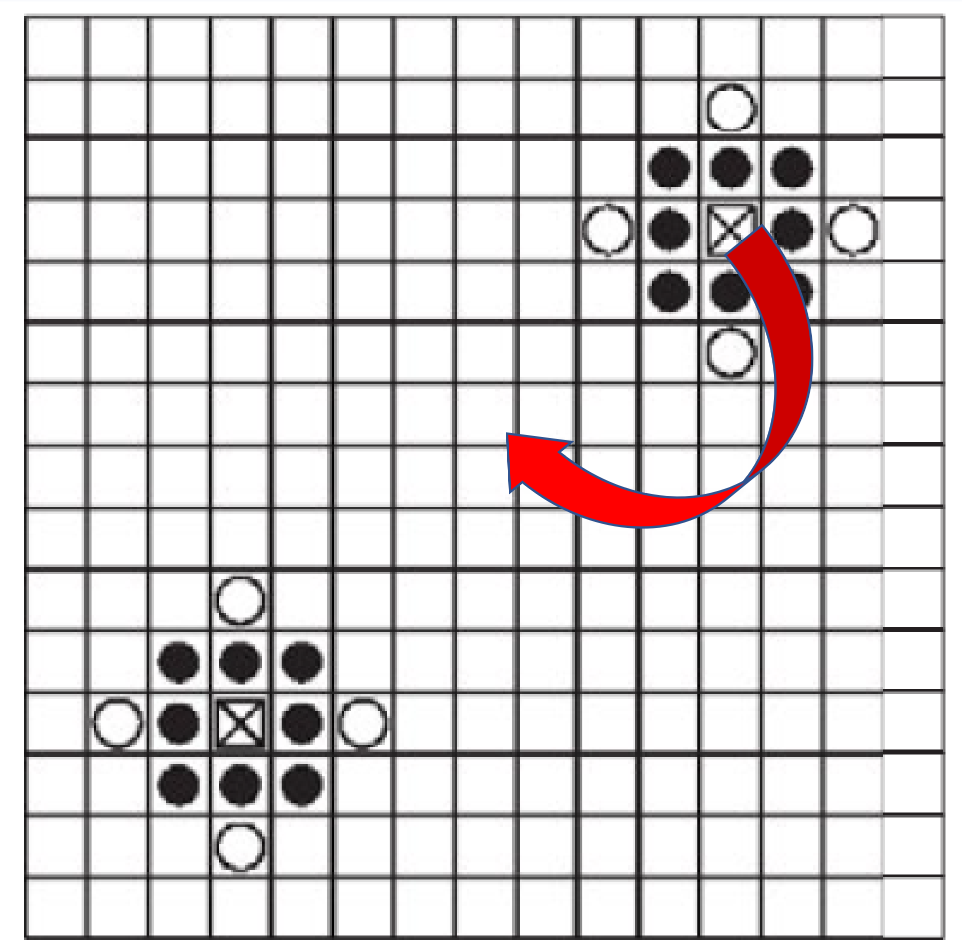

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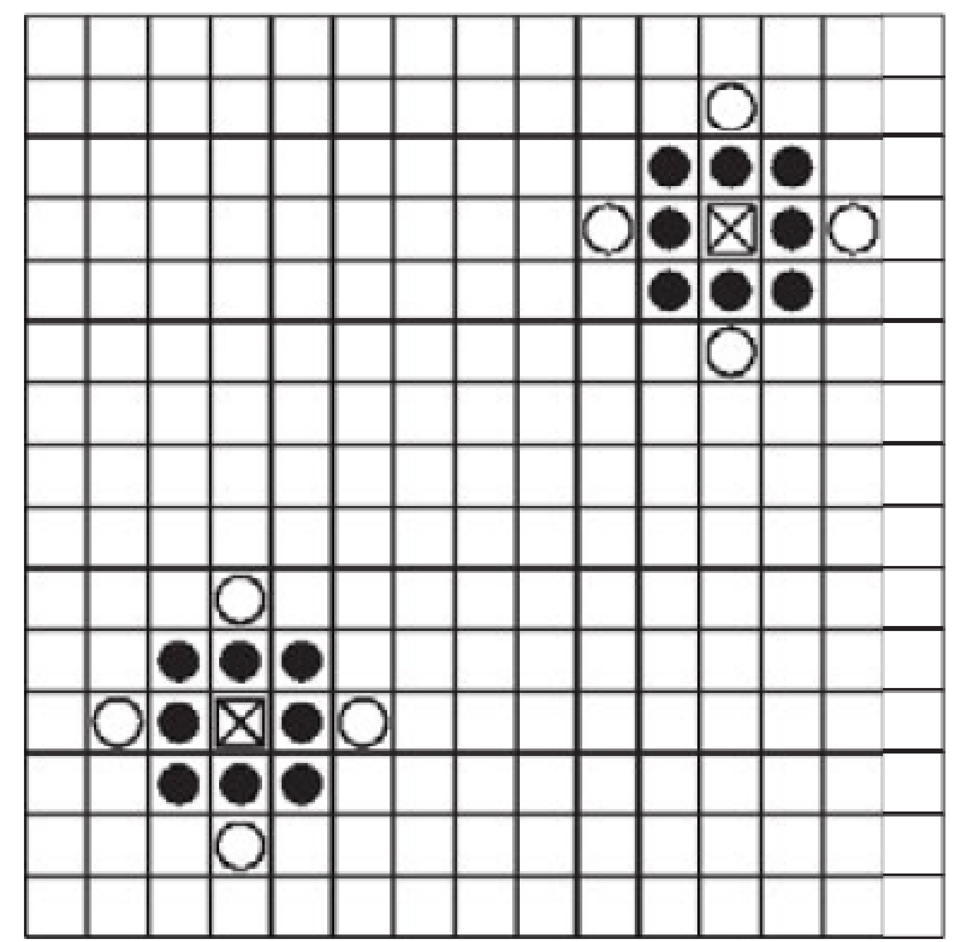

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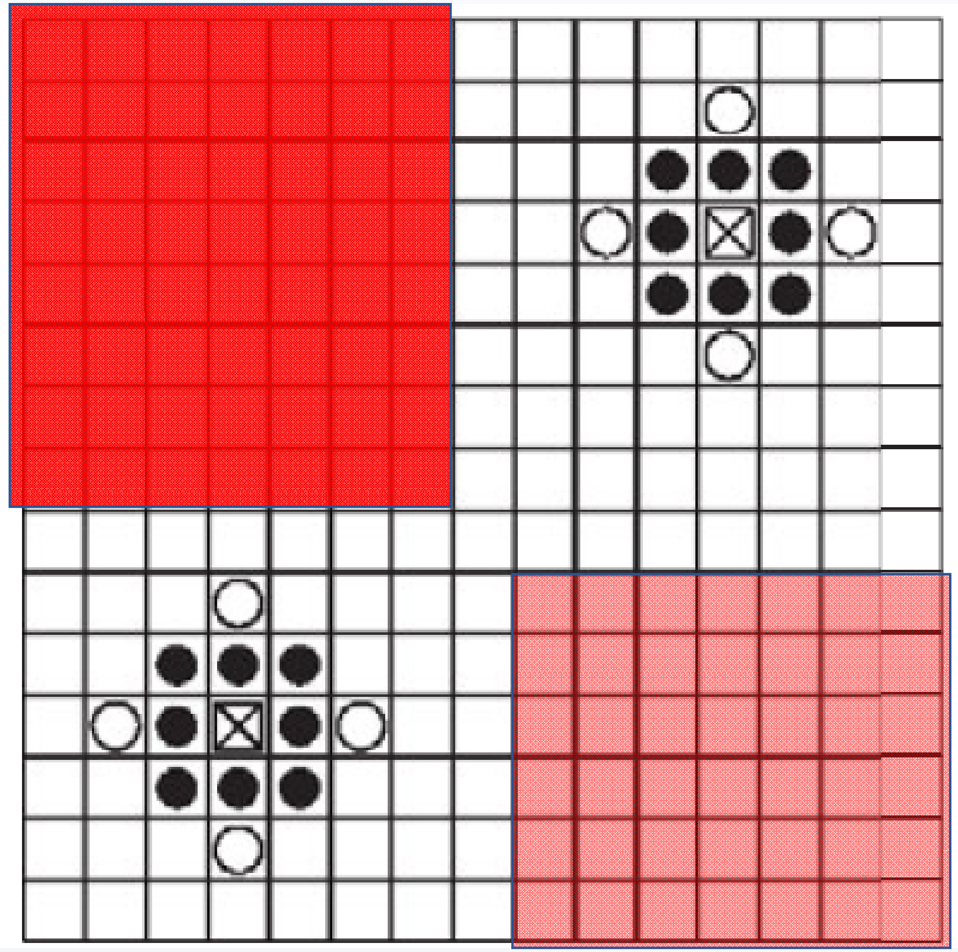

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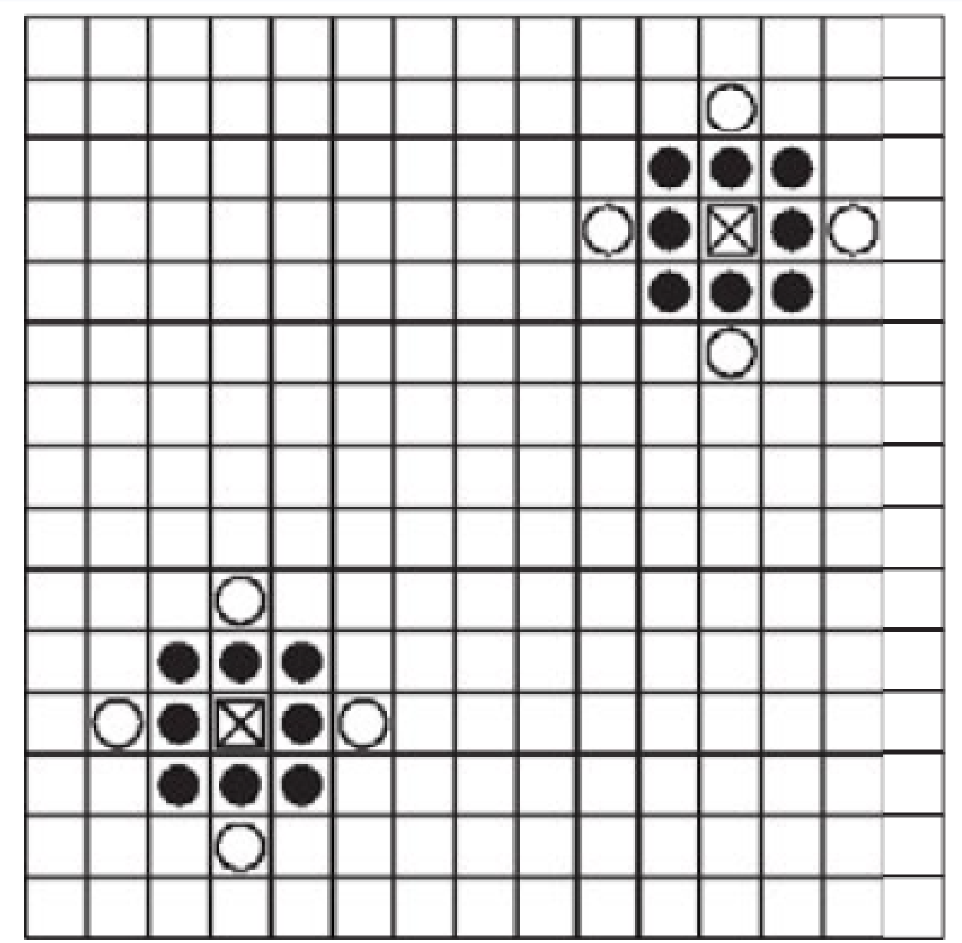

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- Rules to define connectivity among cells are needed
- Cells can be "weighted", for example using SDM
- Particularly useful in large-scale invasions

# Cellular automata and lattice models: example

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A model to simulate the spread and management cost of kudzu (*Pueraria montana* var. *lobata*) at landscape scale☆

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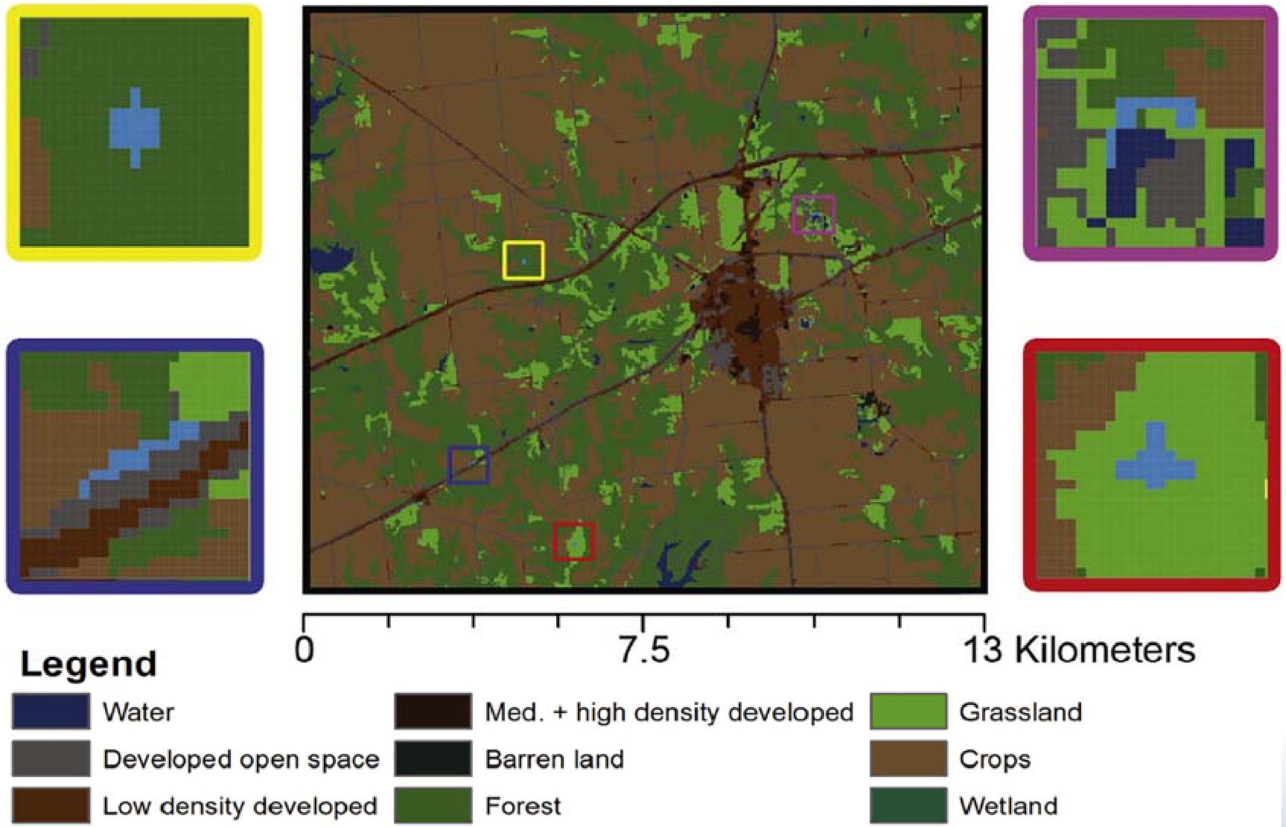


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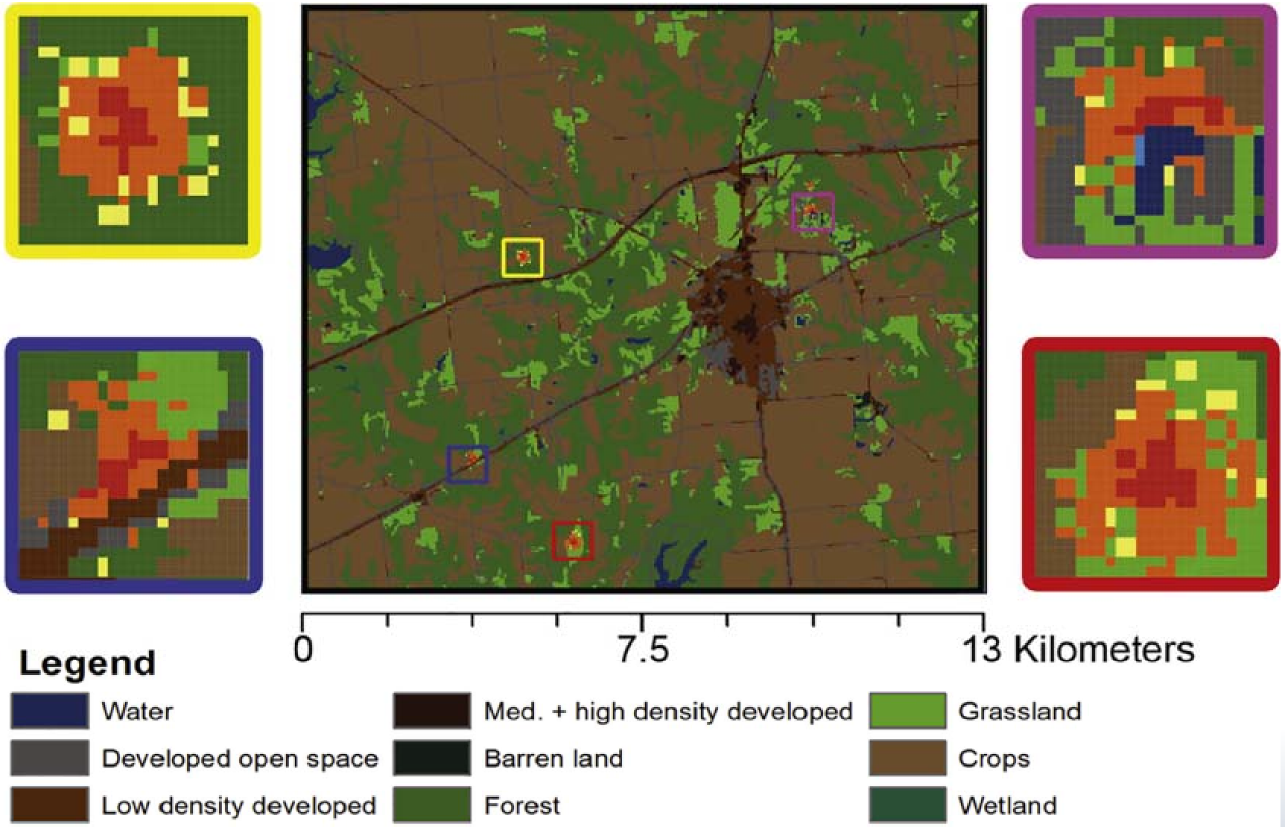


Metapopulation, gravity and network models: only some specific cells (nodes) of the space are utilized and connected by edges

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DOI 10.1007/s10530-013-0552-6

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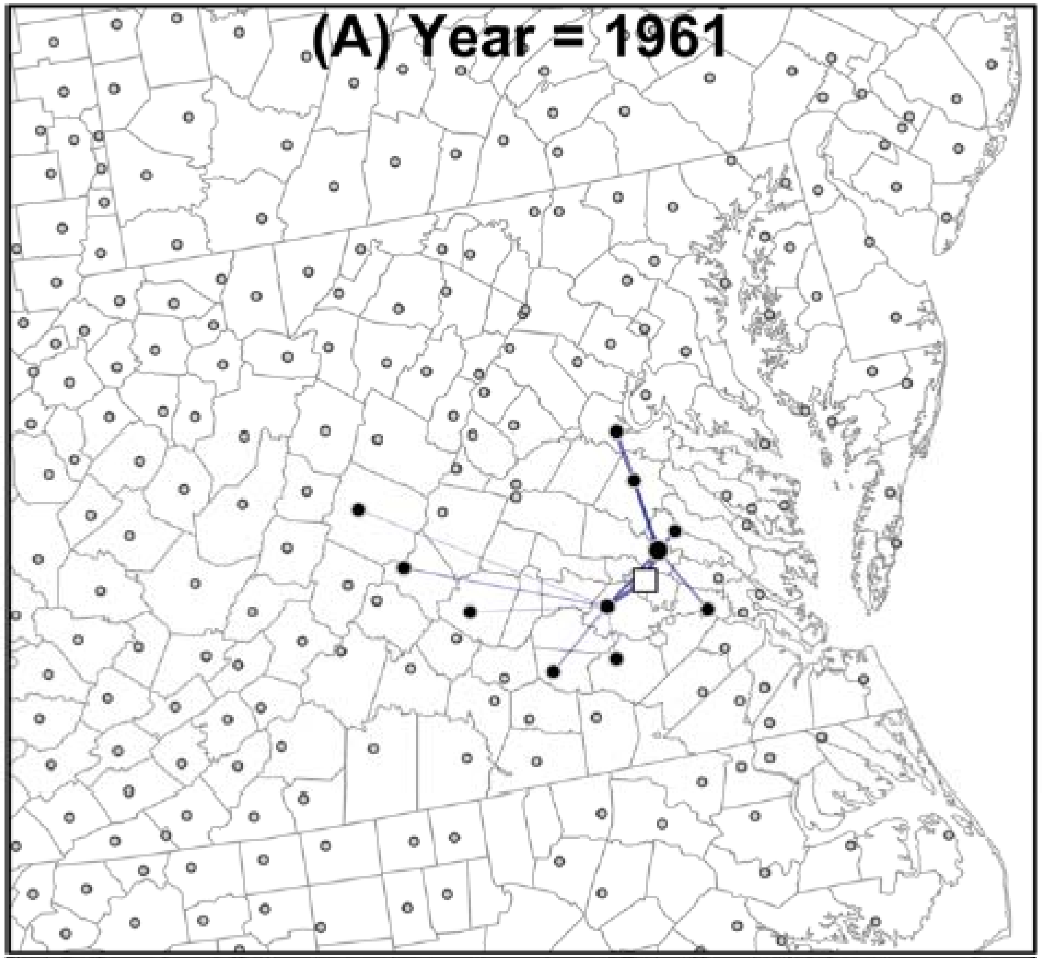


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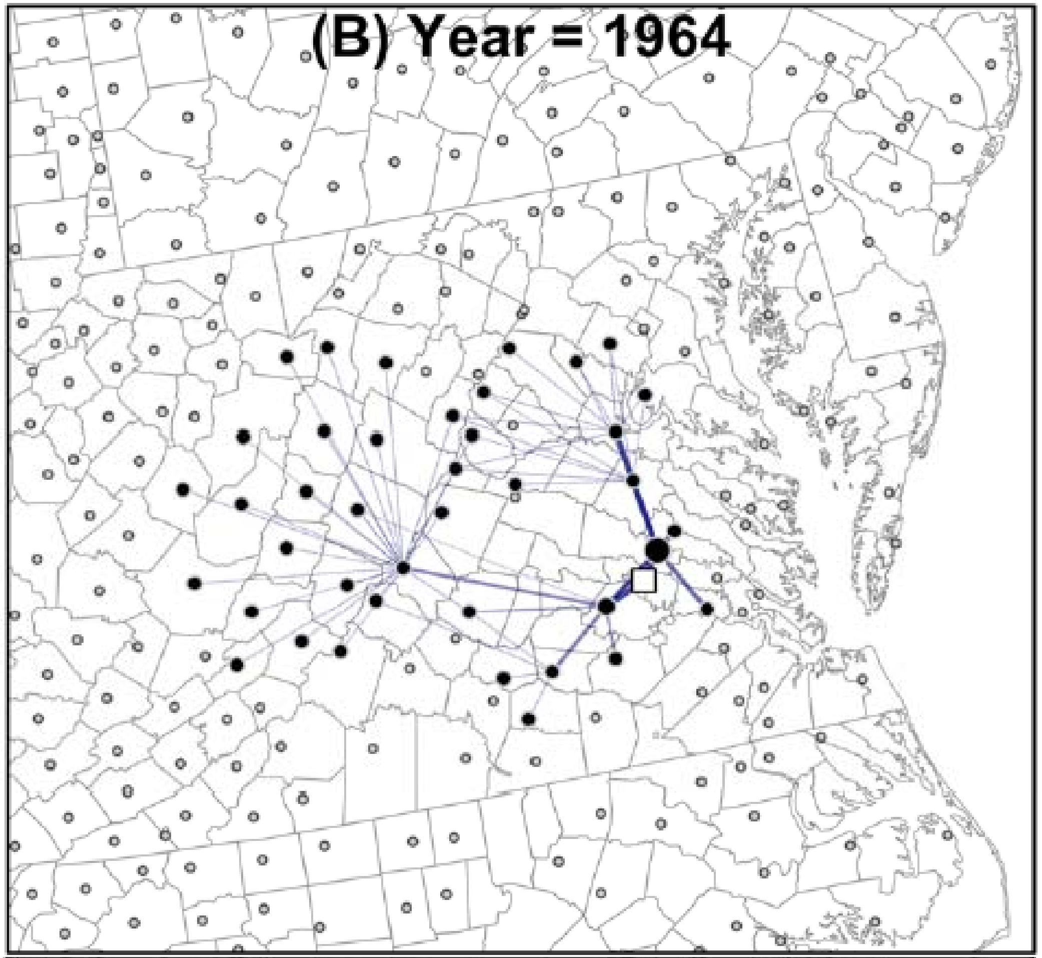


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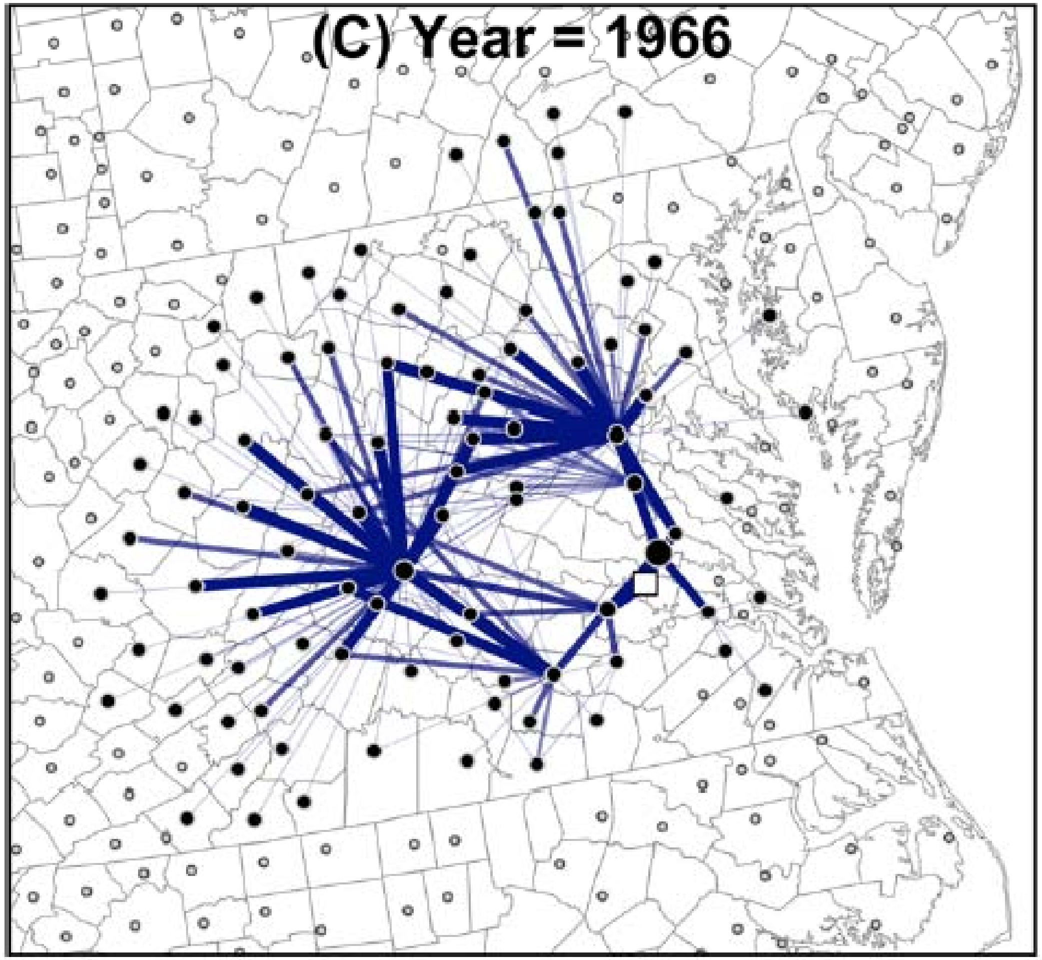


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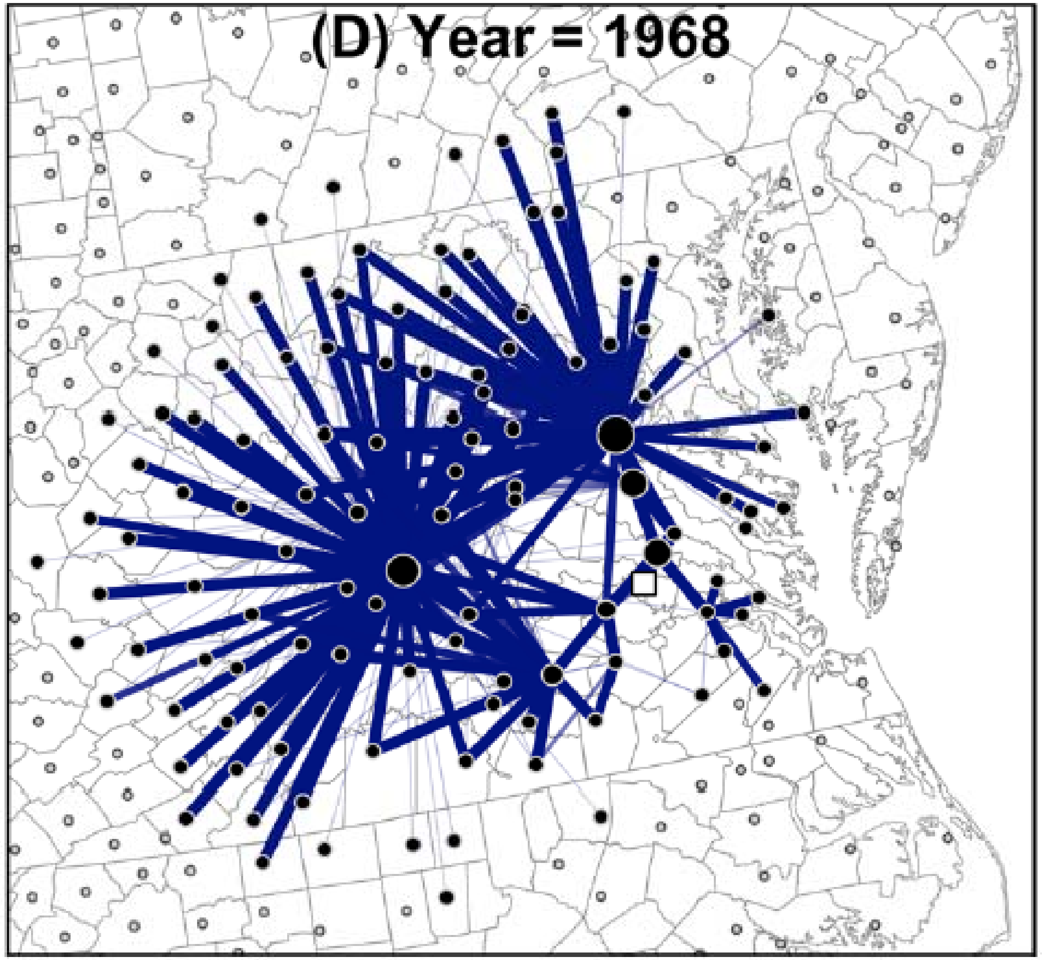


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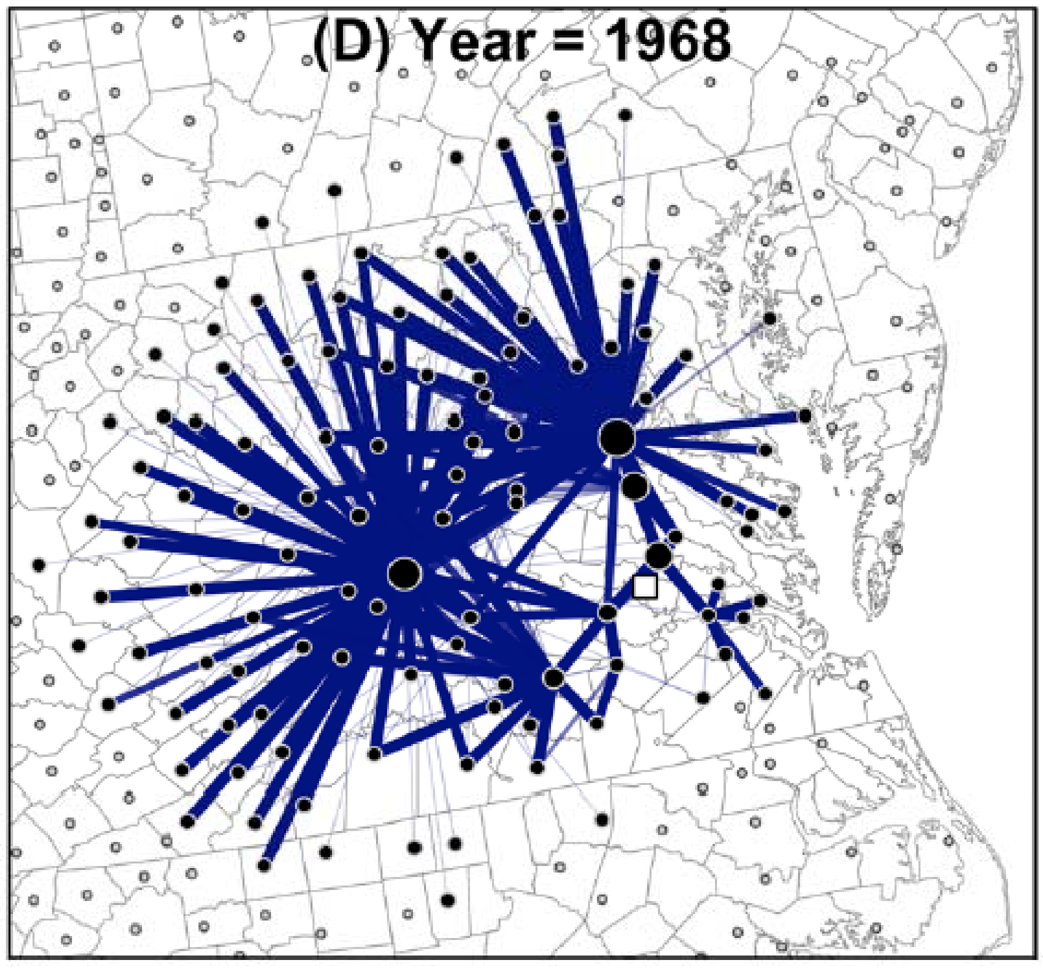


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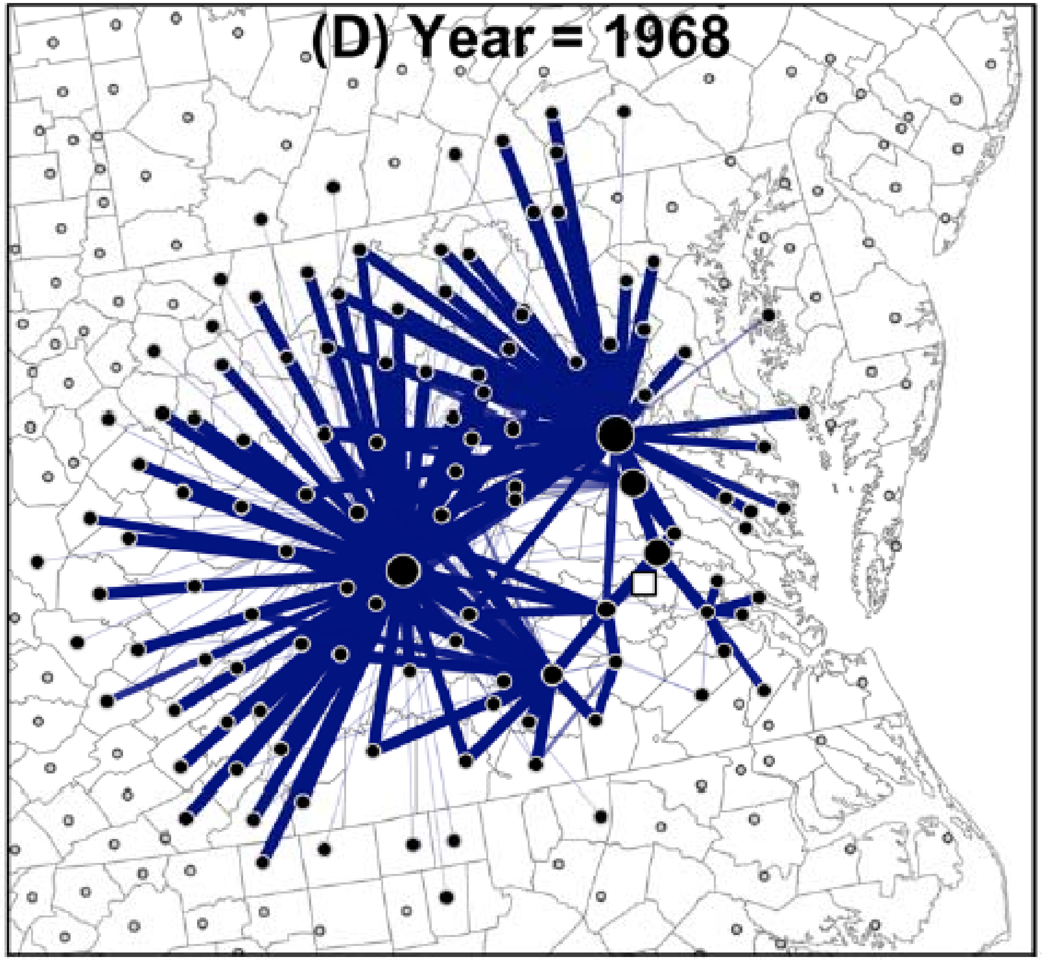


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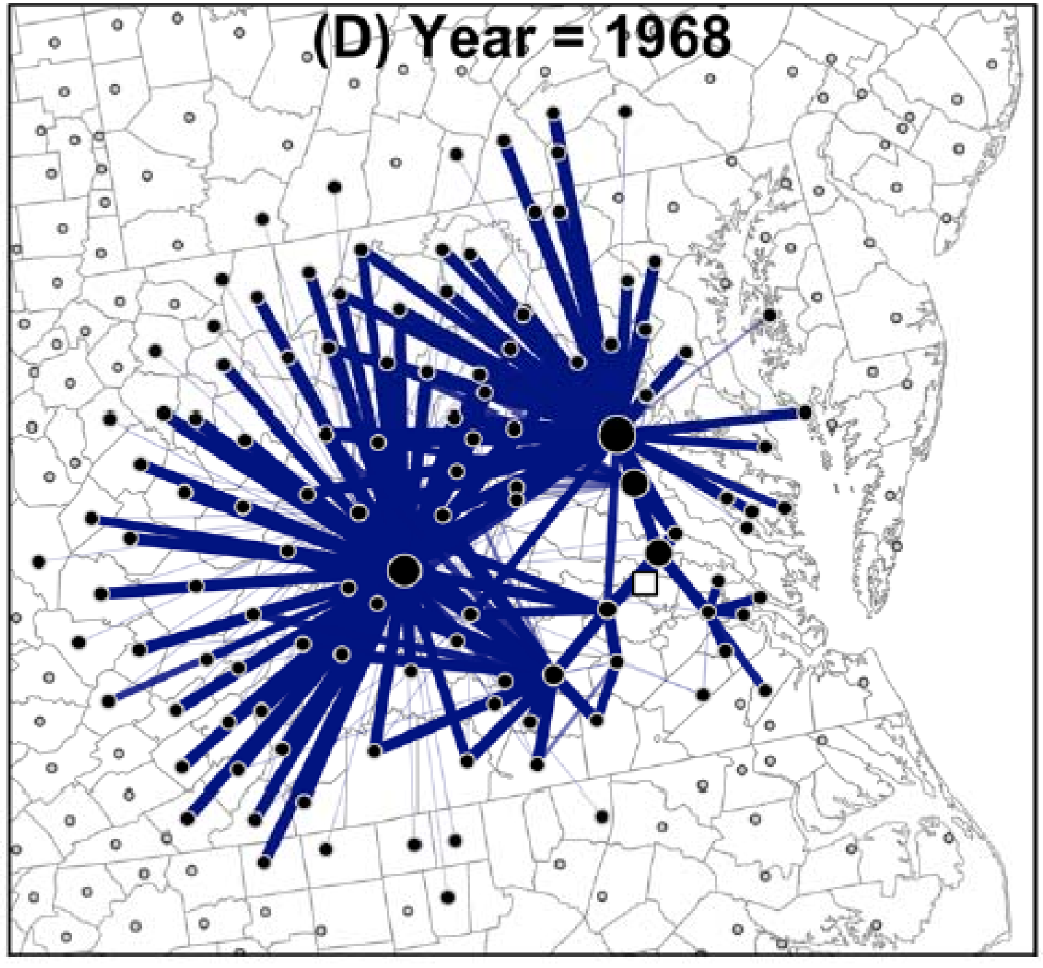


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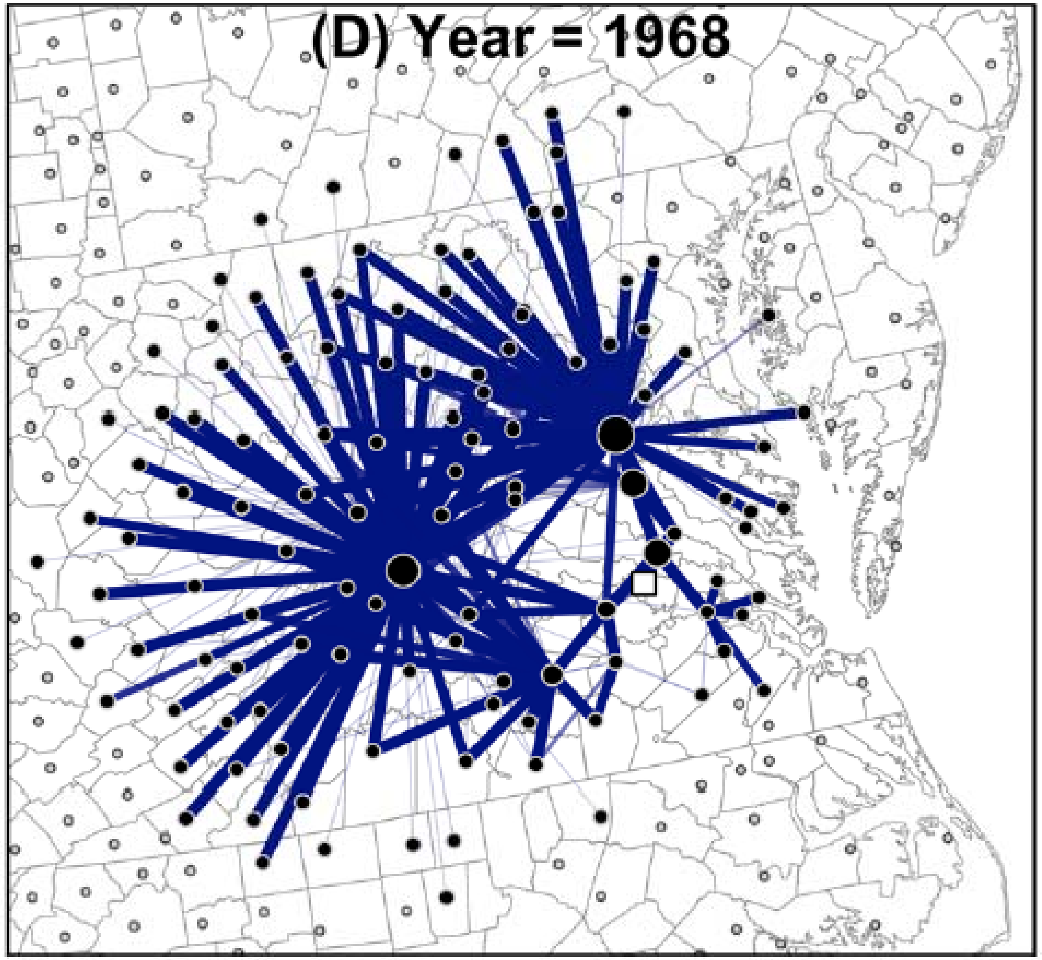


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- Each edge can be regulated by dispersal and behavioral rules
- Management can be simulated at nodes and edges
- Particularly useful to target freshwater aquatic invaders or urban invaders

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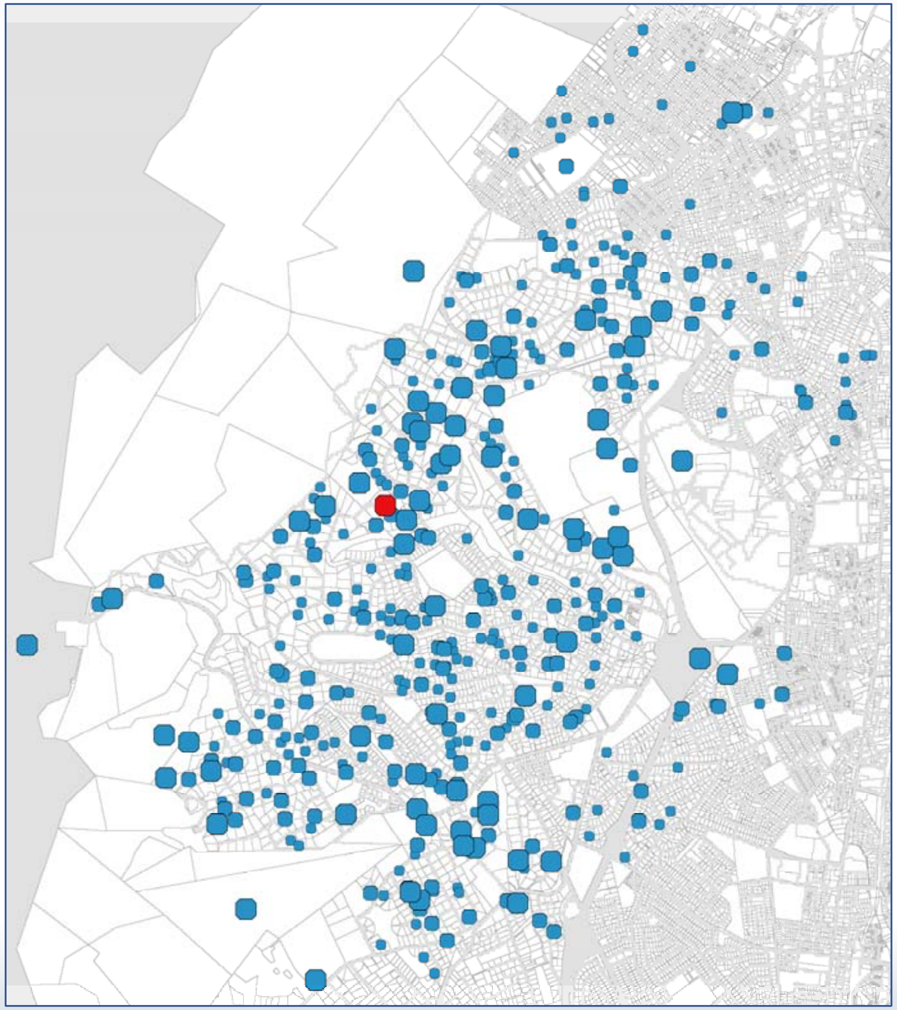

Integrating age structured and landscape resistance models to disentangle invasion dynamics of a pond-breeding anuran

Giovanni Vimercati [a,*], Cang Hui [b,c], Sarah J. Davies [a], G. John Measey [a]

Ecological Modelling 356 (2017) 104–116

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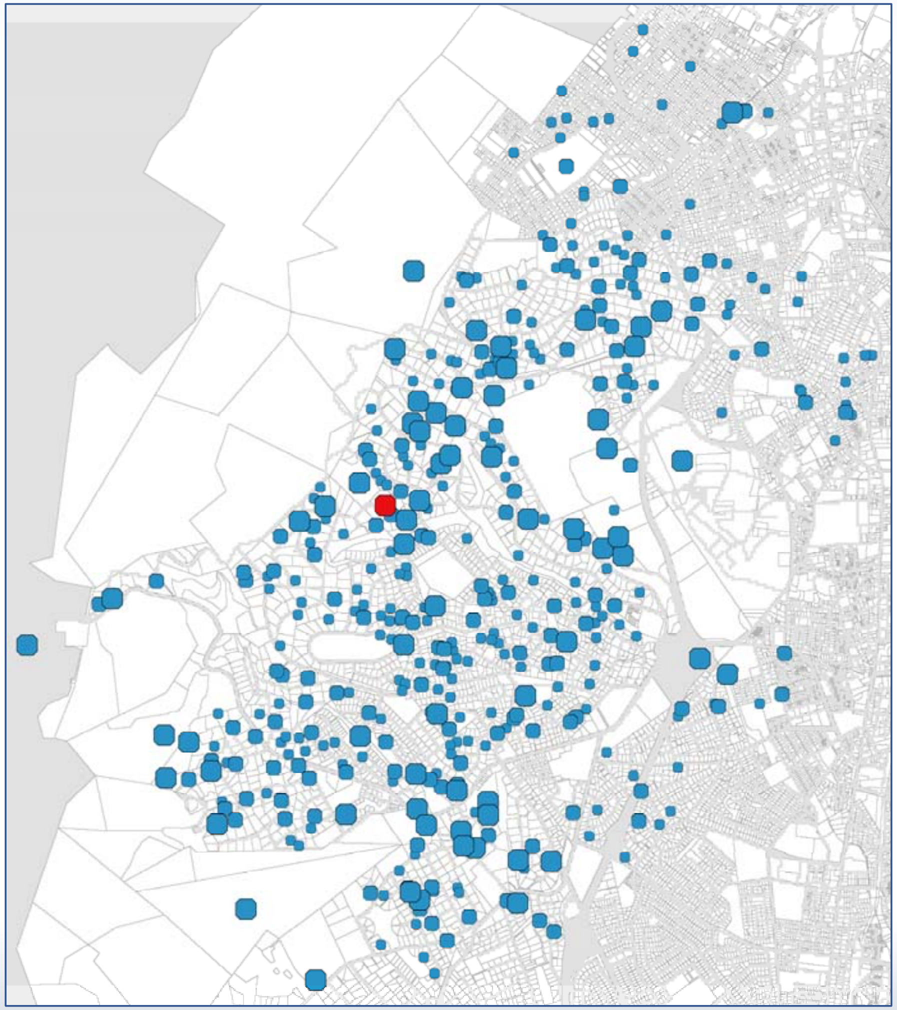

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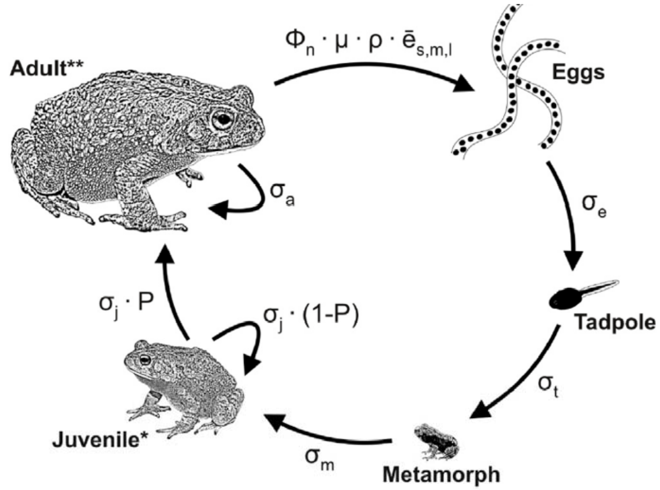


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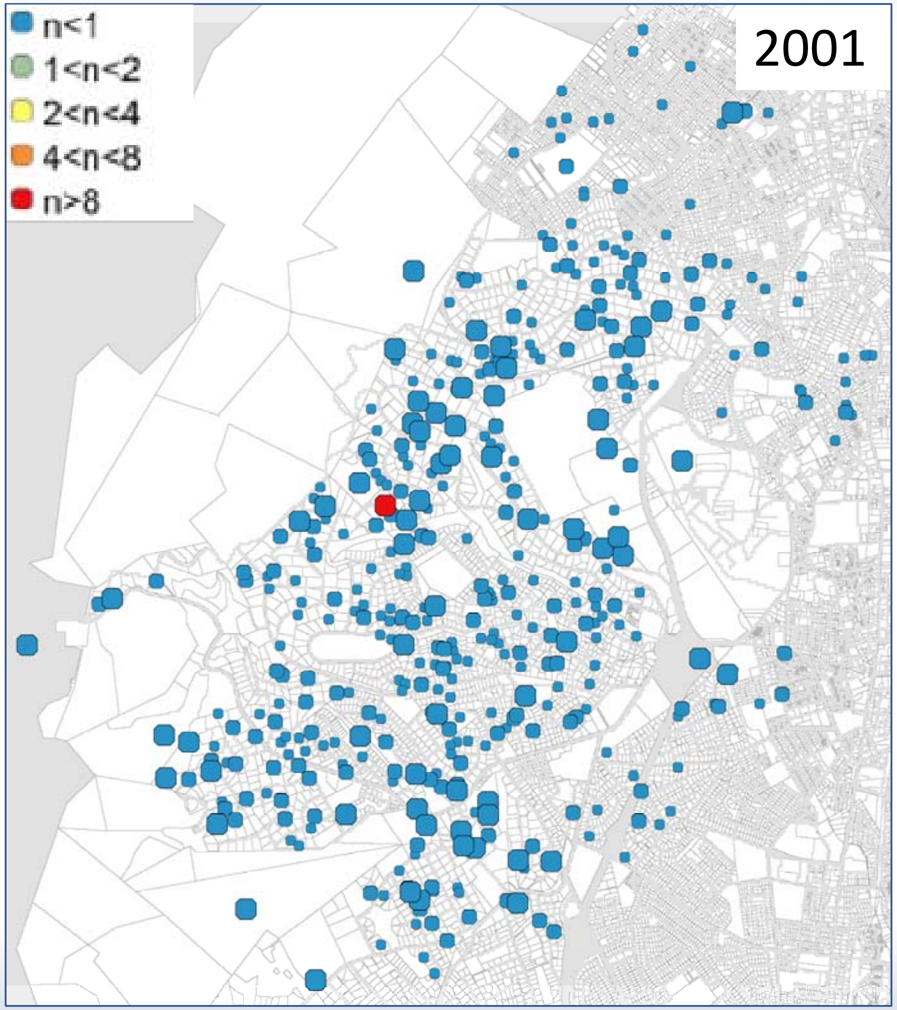


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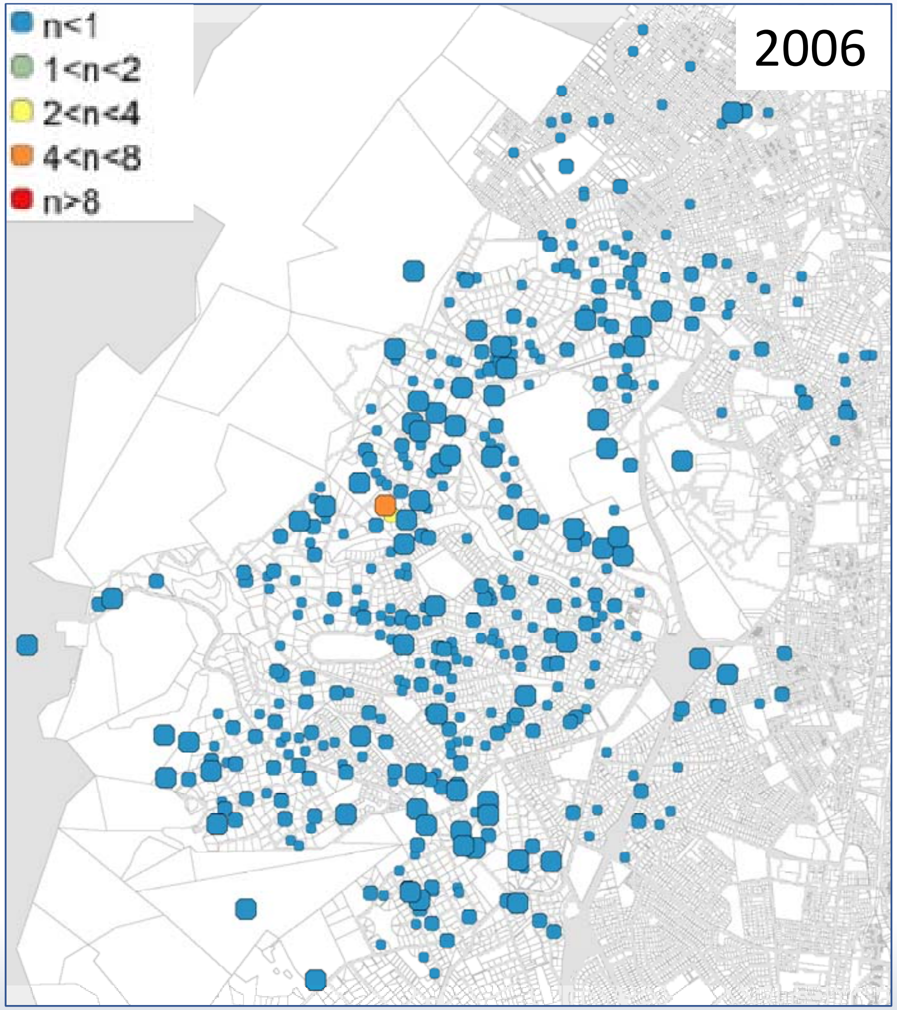


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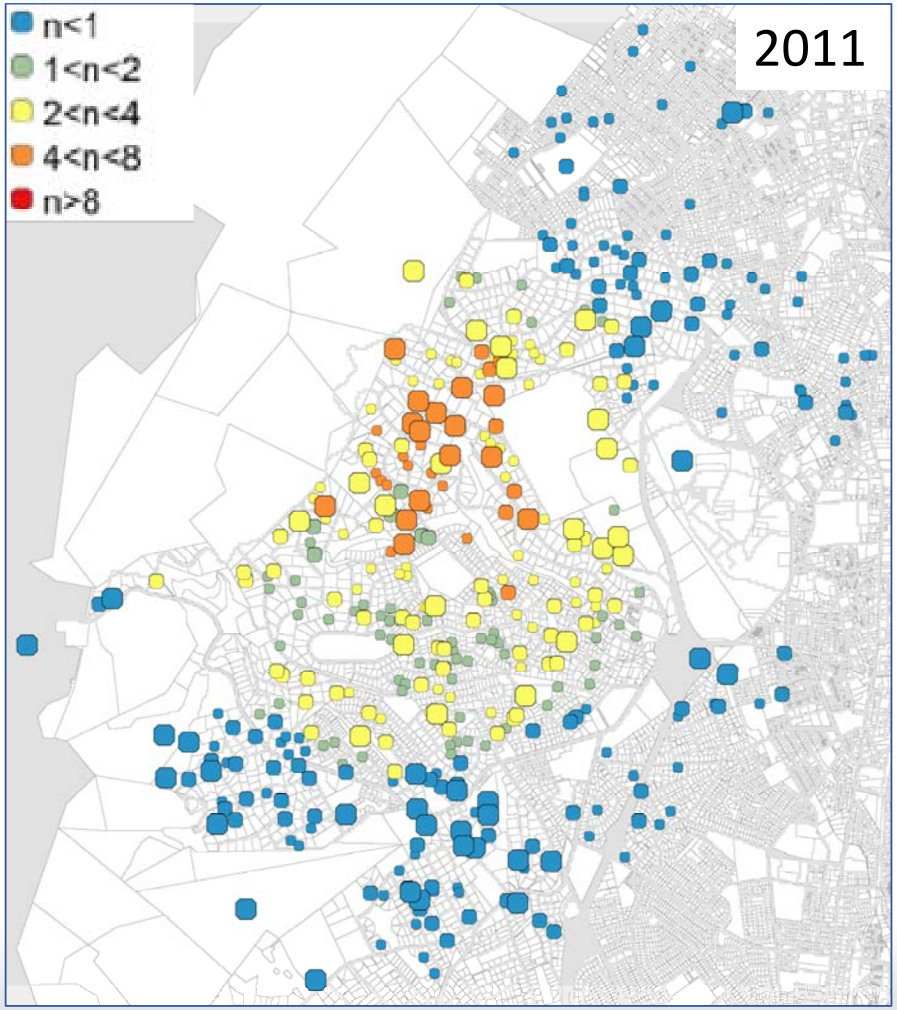


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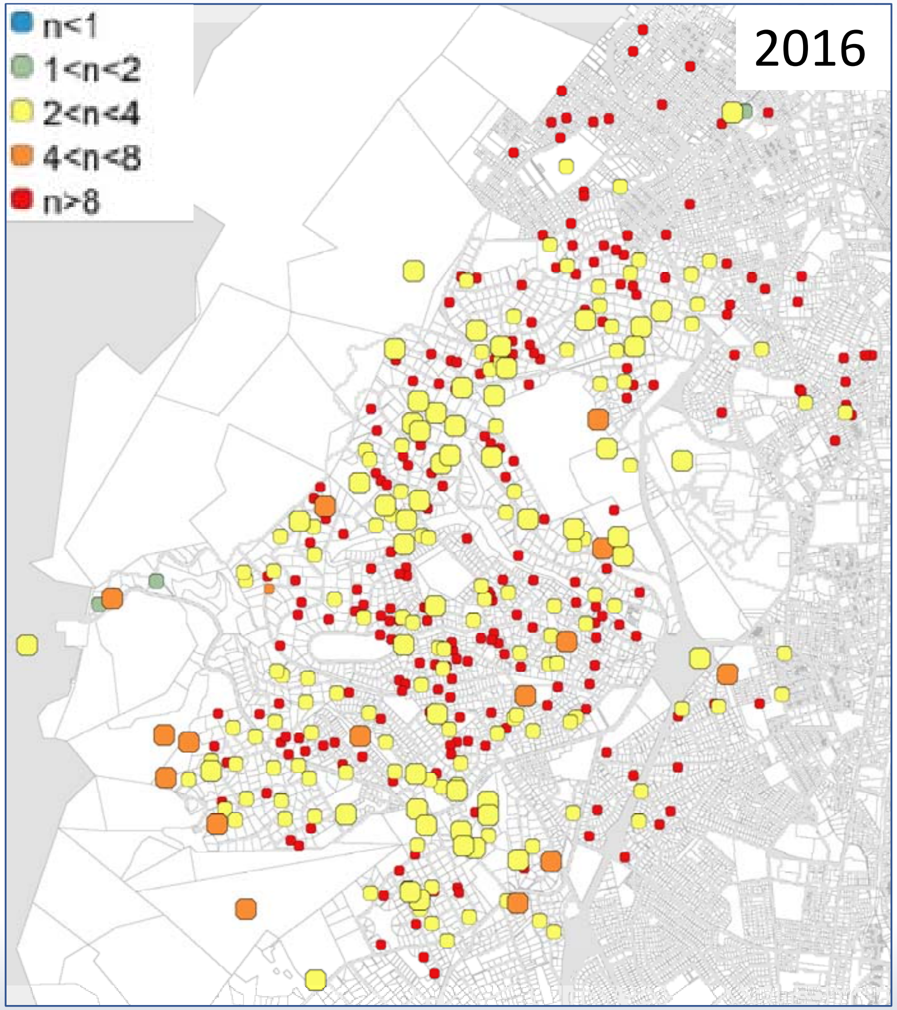


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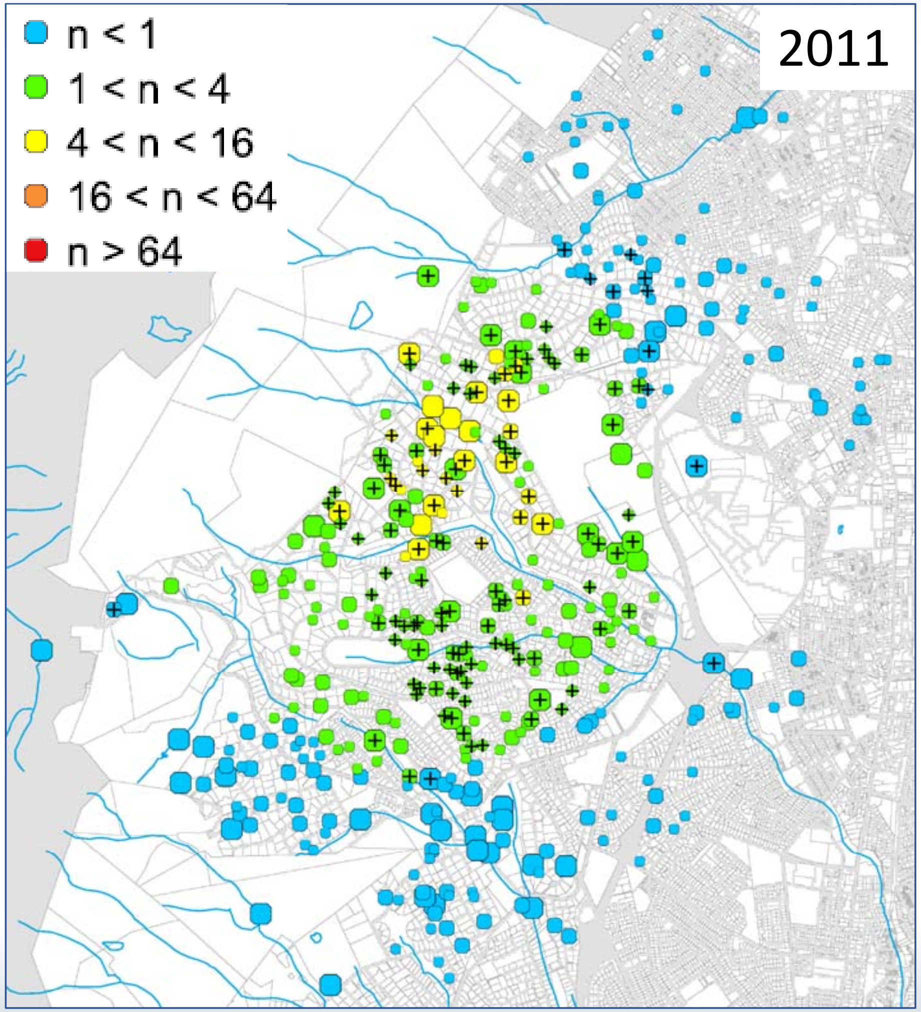


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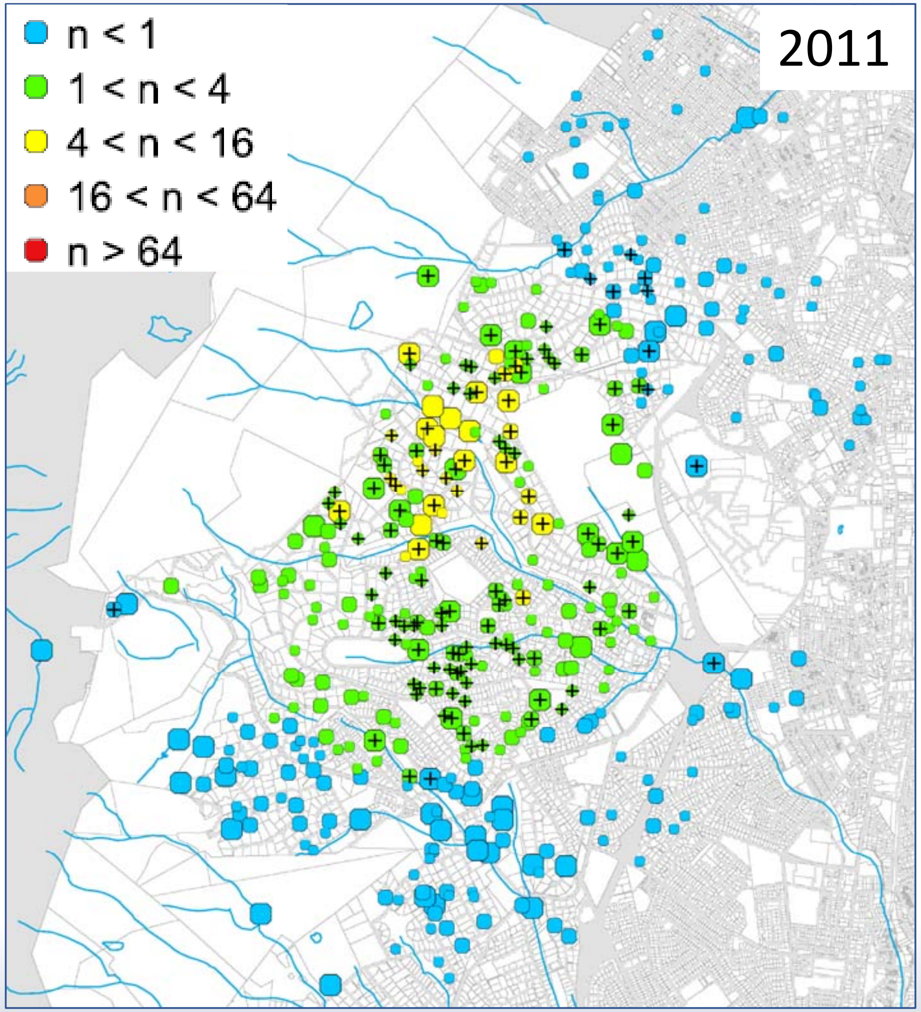


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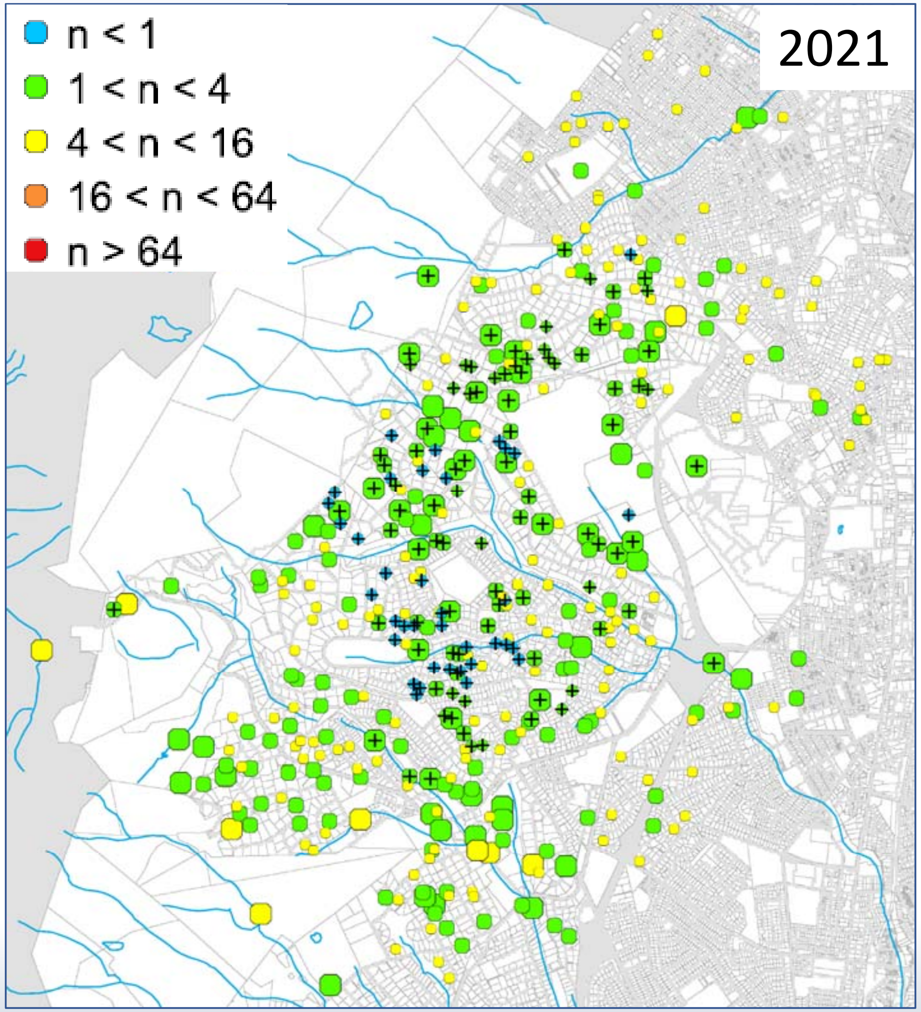


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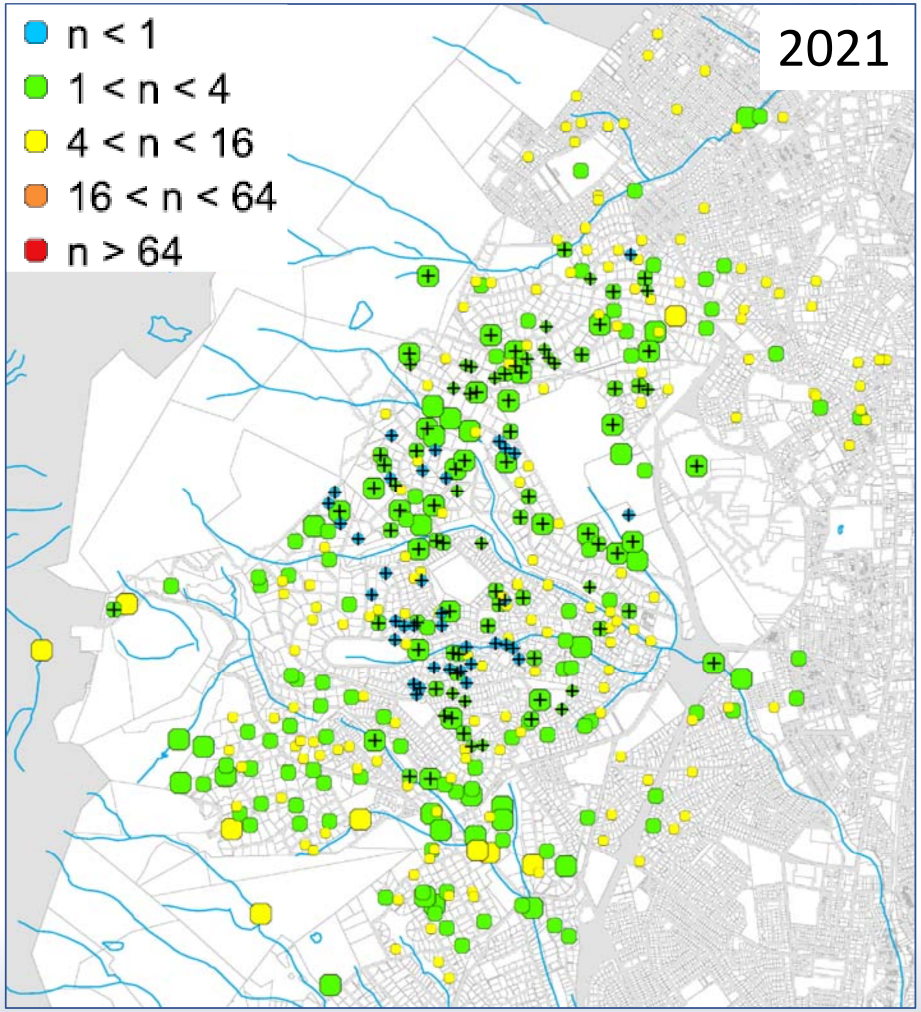
# Metapopulation, gravity and network models: example




Biol Invasions
DOI 10.1007/s10530-017-1599-6

CrossMark

URBAN INVASIONS

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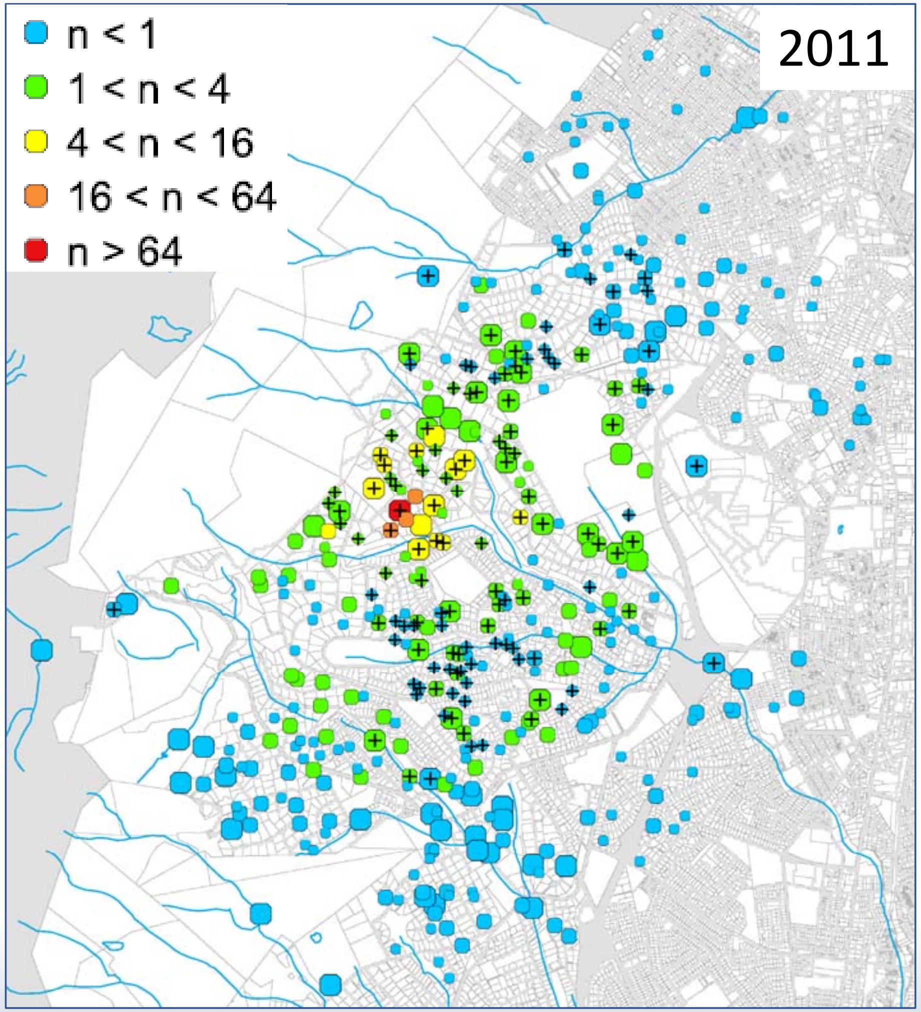


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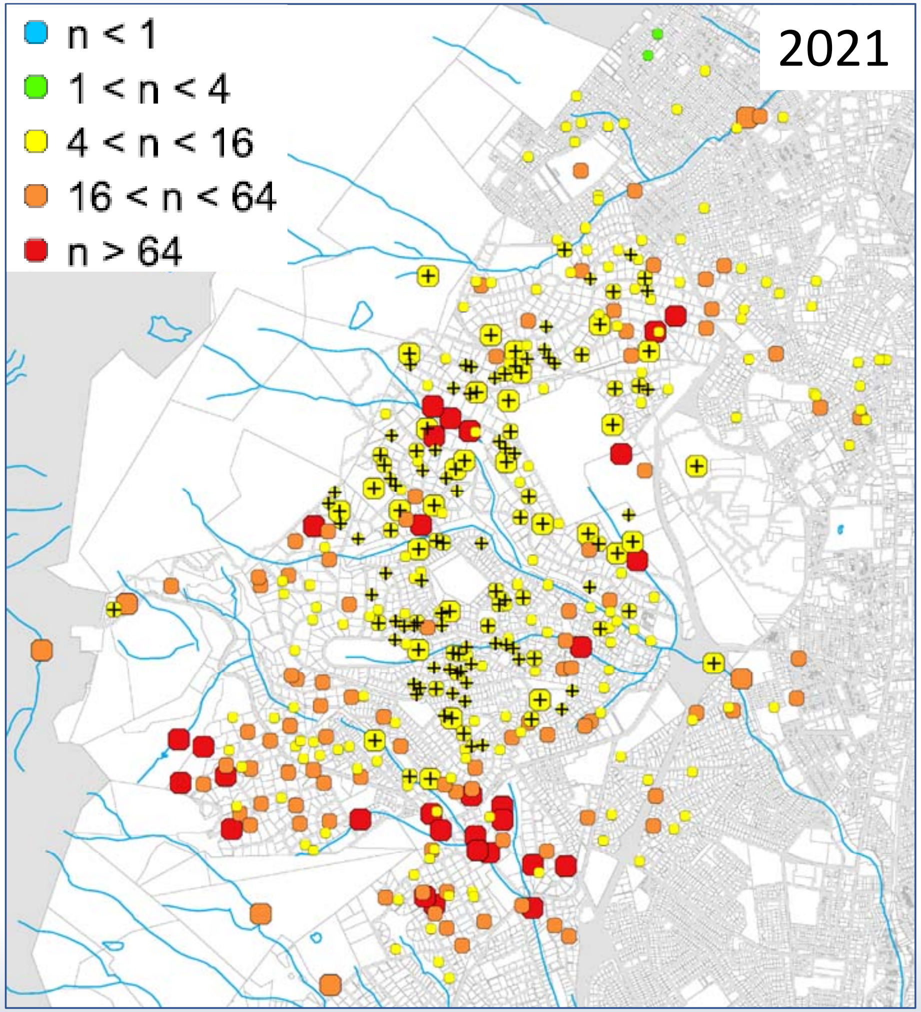


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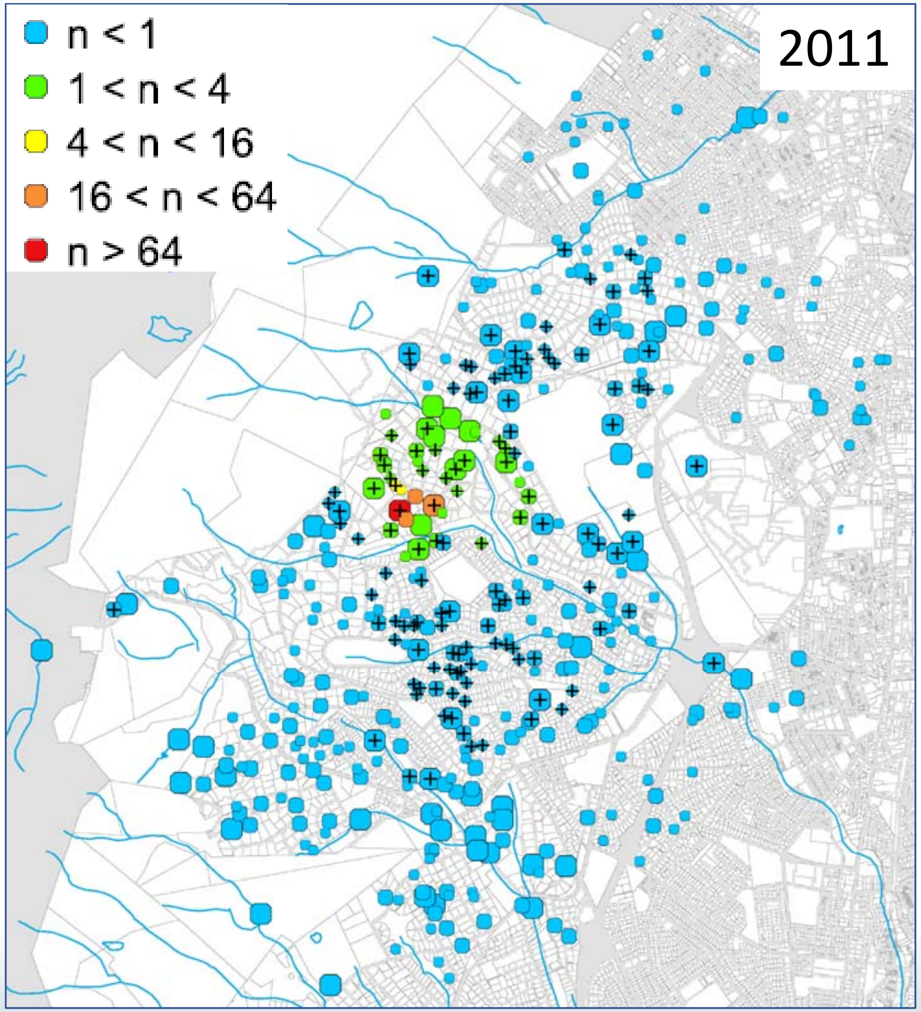


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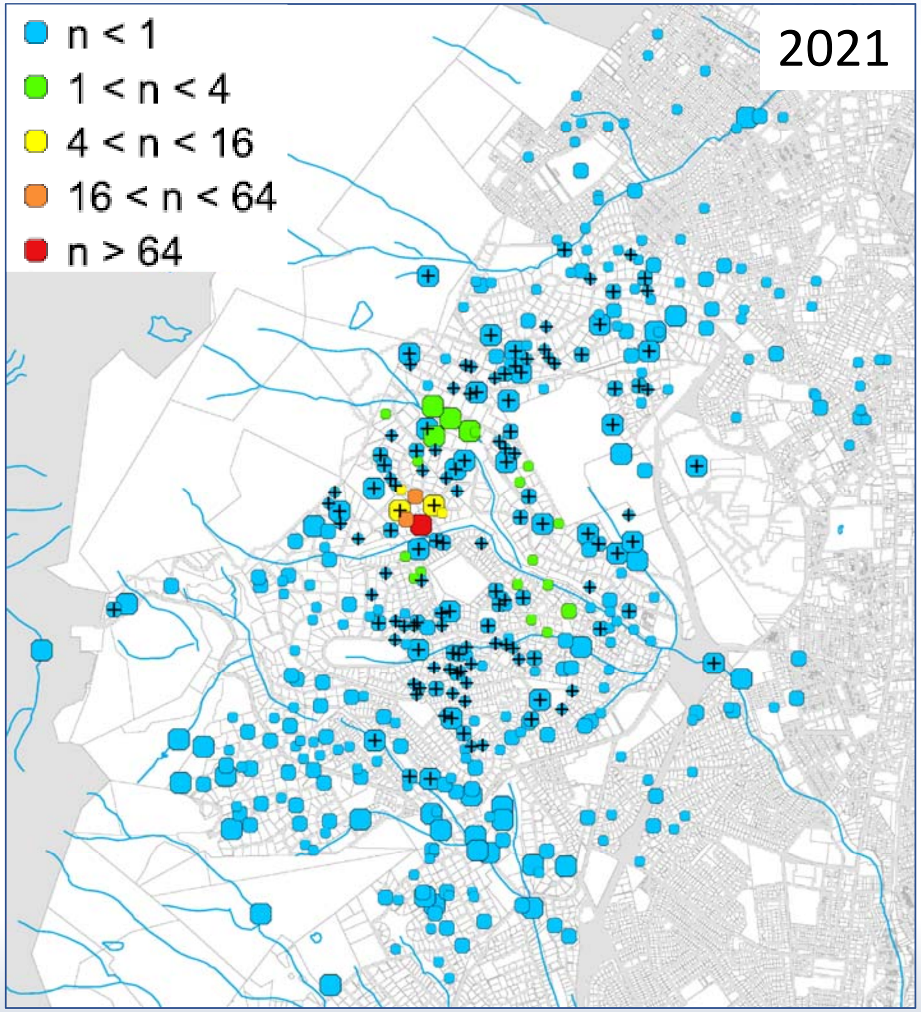


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Individual based models: bottom-up approach that “tracks” each individual across space

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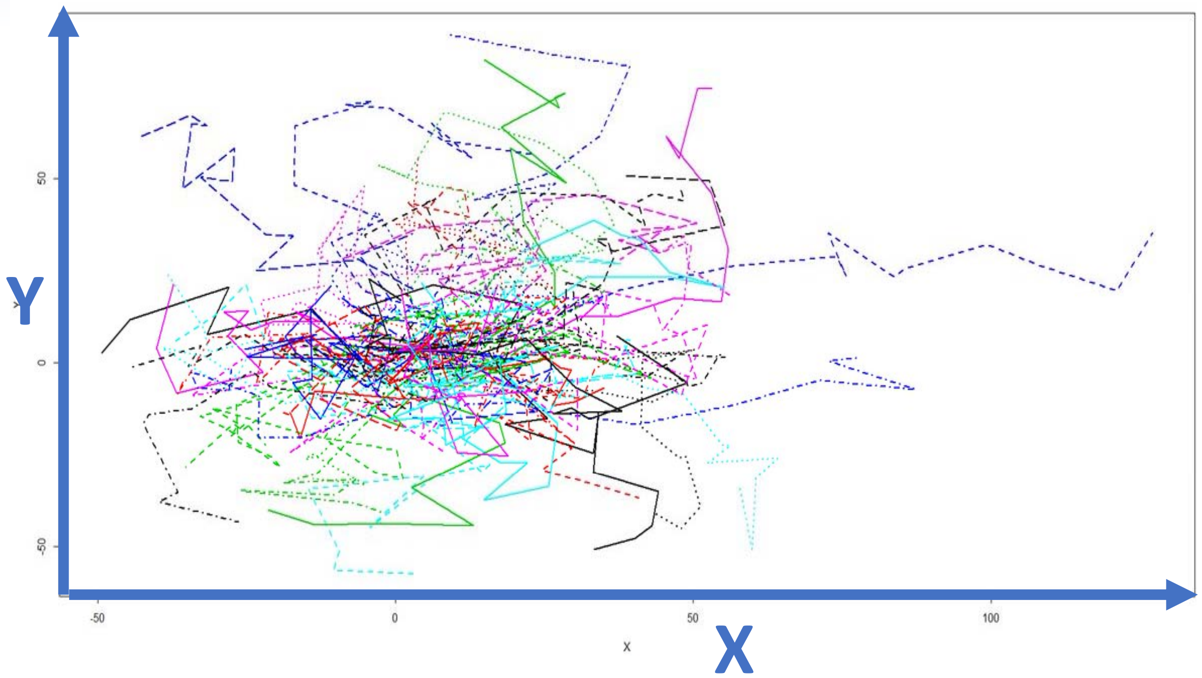


Dispersal of 50 frog computed by Dr. Pablo Garcia-Diaz

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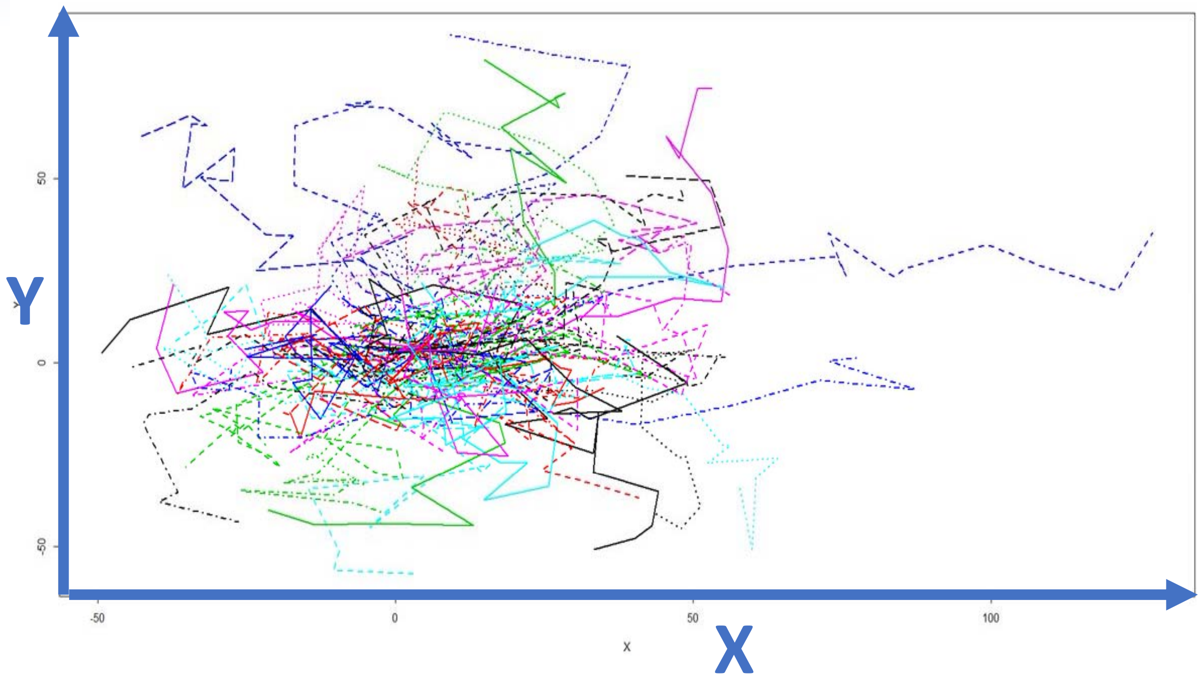
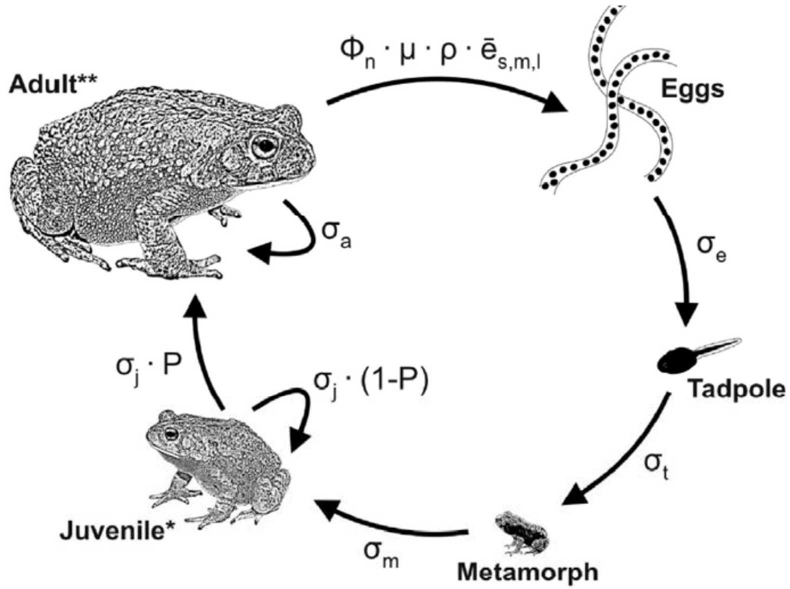



Dispersal of 50 invasive cane toads computed by Dr. Pablo Garcia-Diaz

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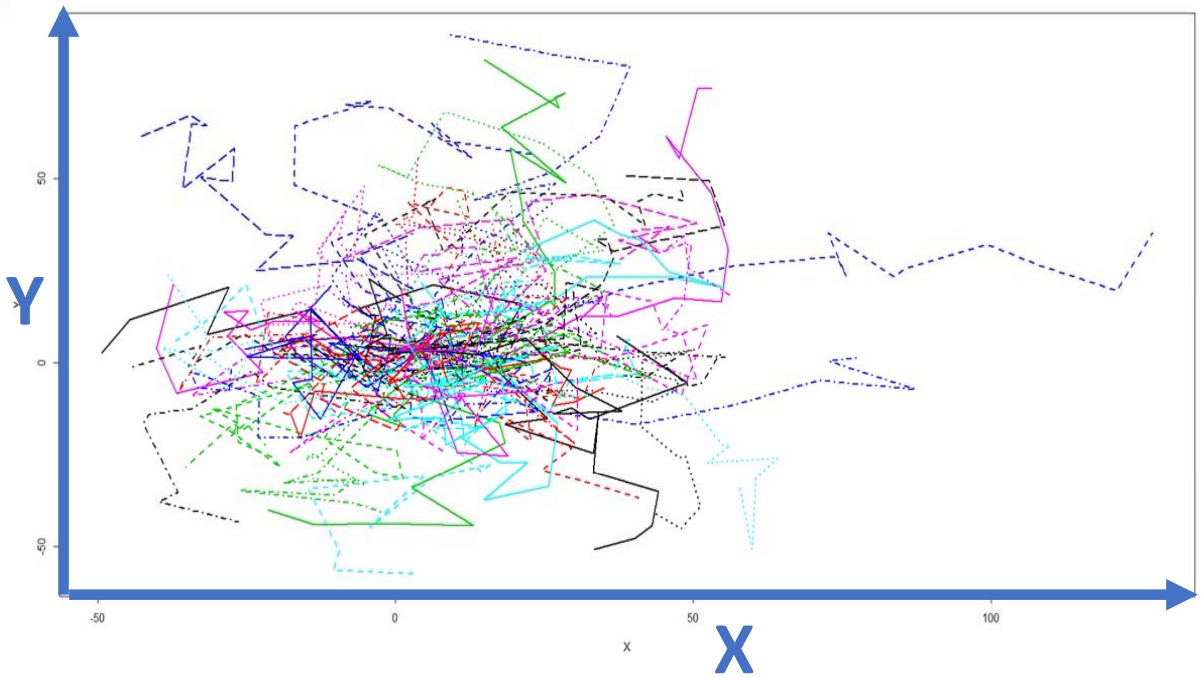


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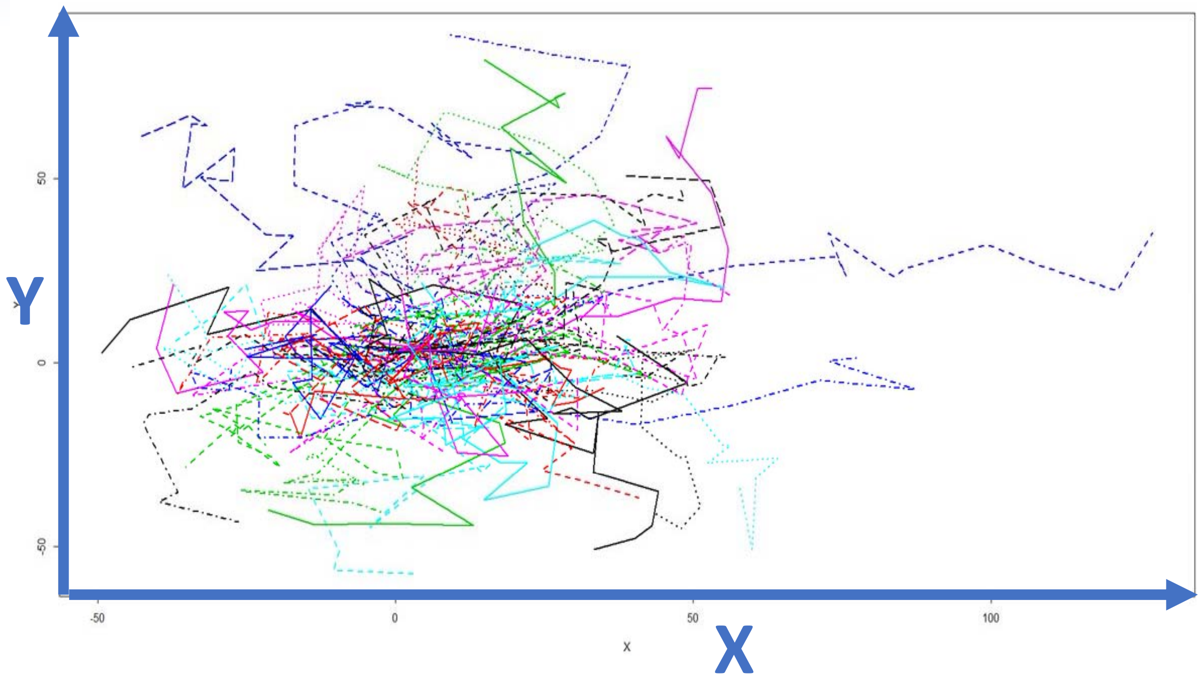


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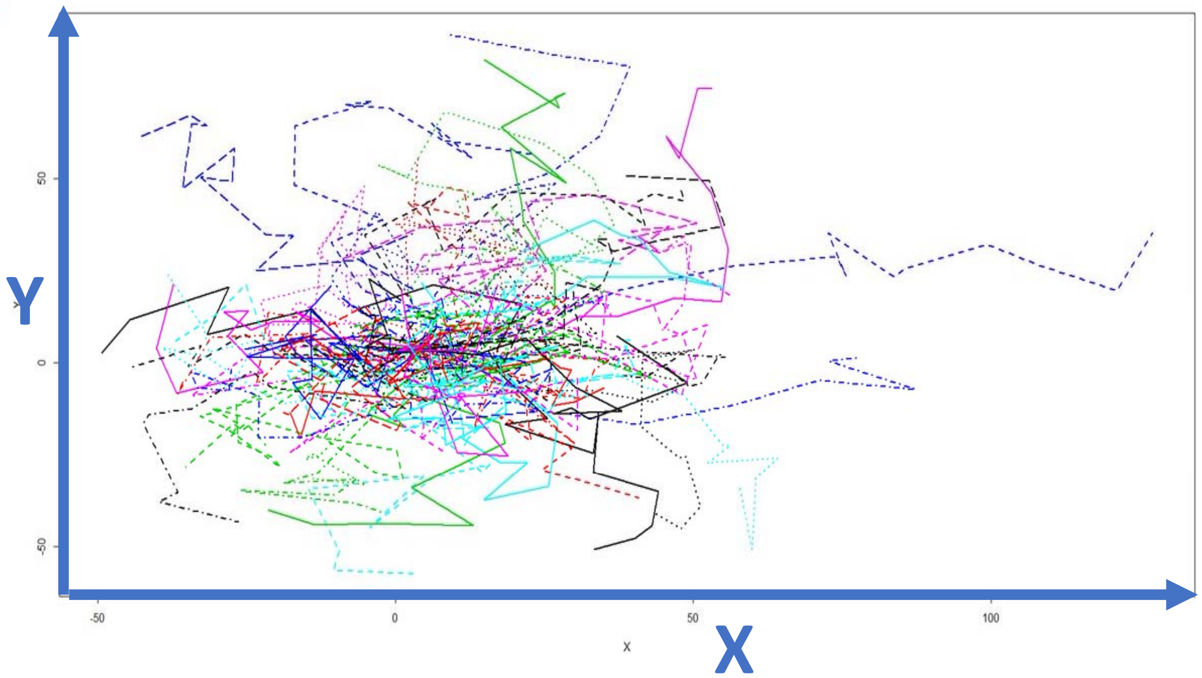


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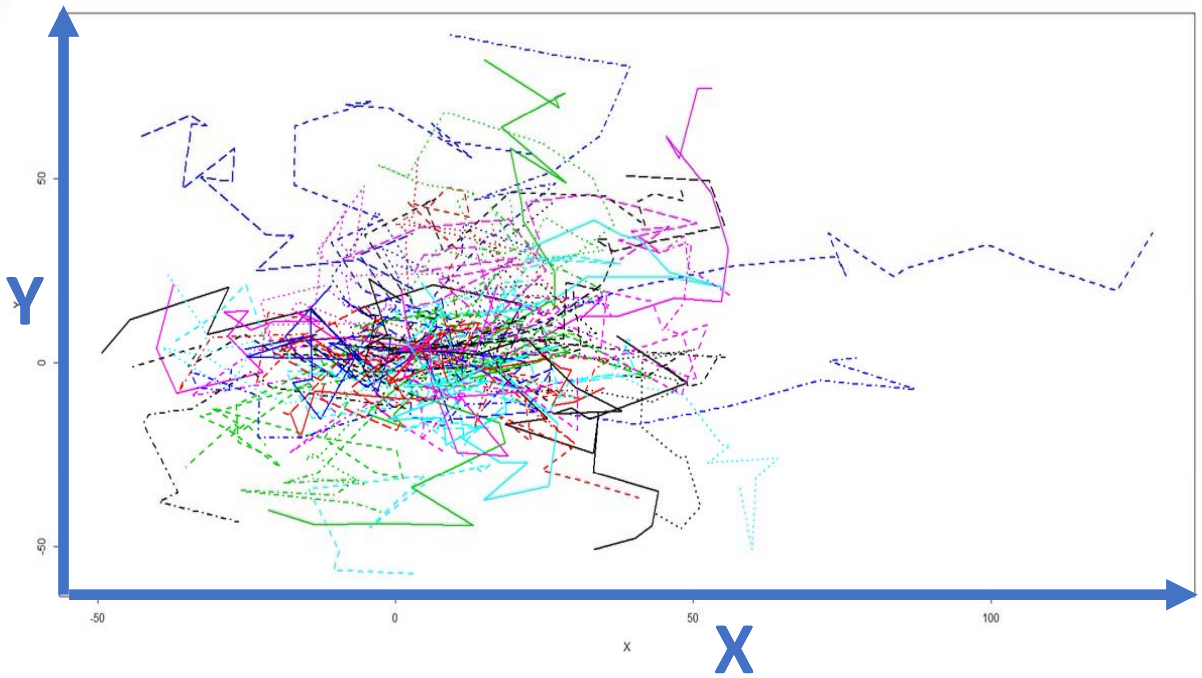


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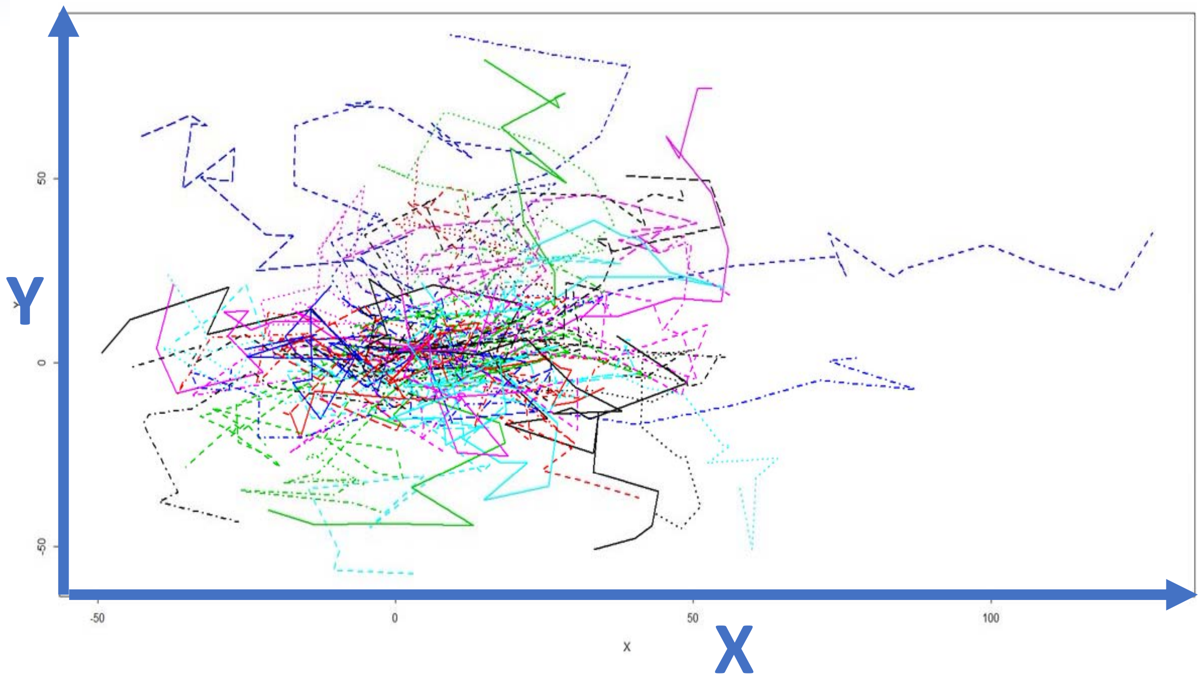


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- **It can be run into a cellular automata model or a metapopulation model**

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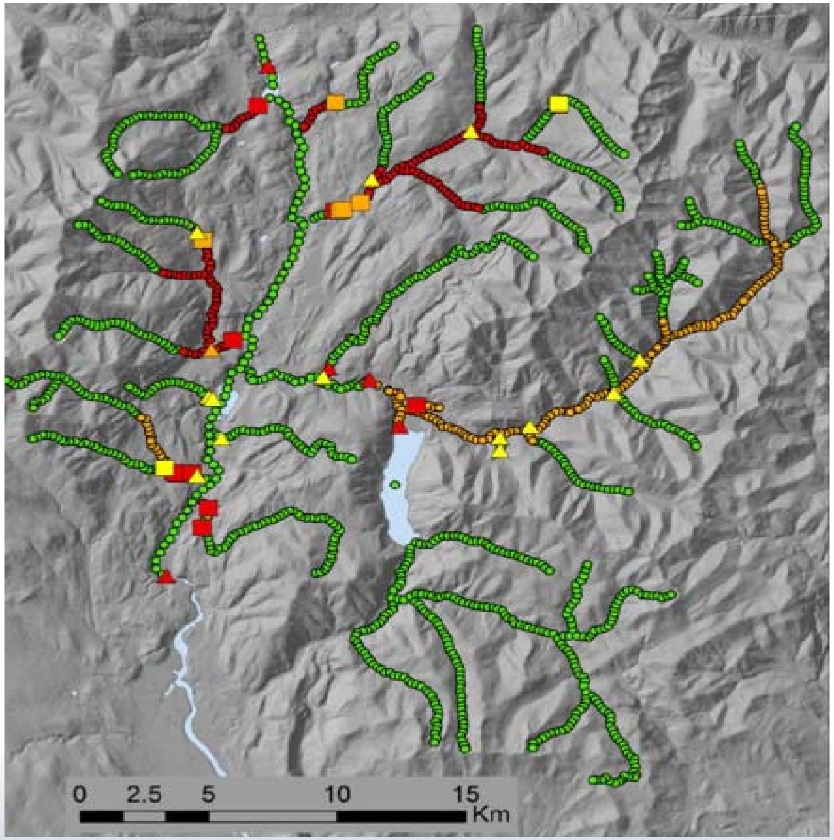
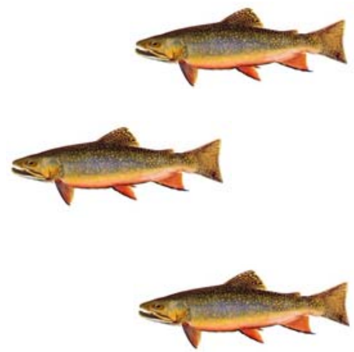
Biological Conservation 221 (2018) 10–22



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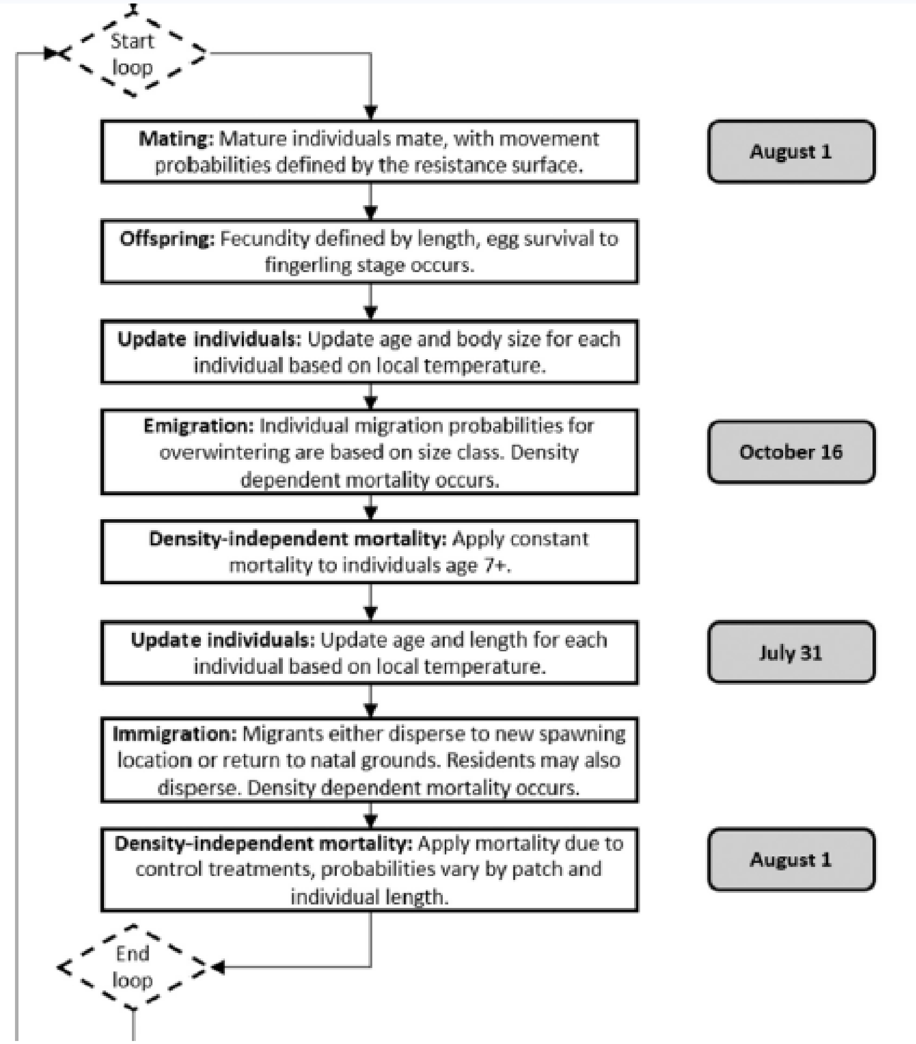


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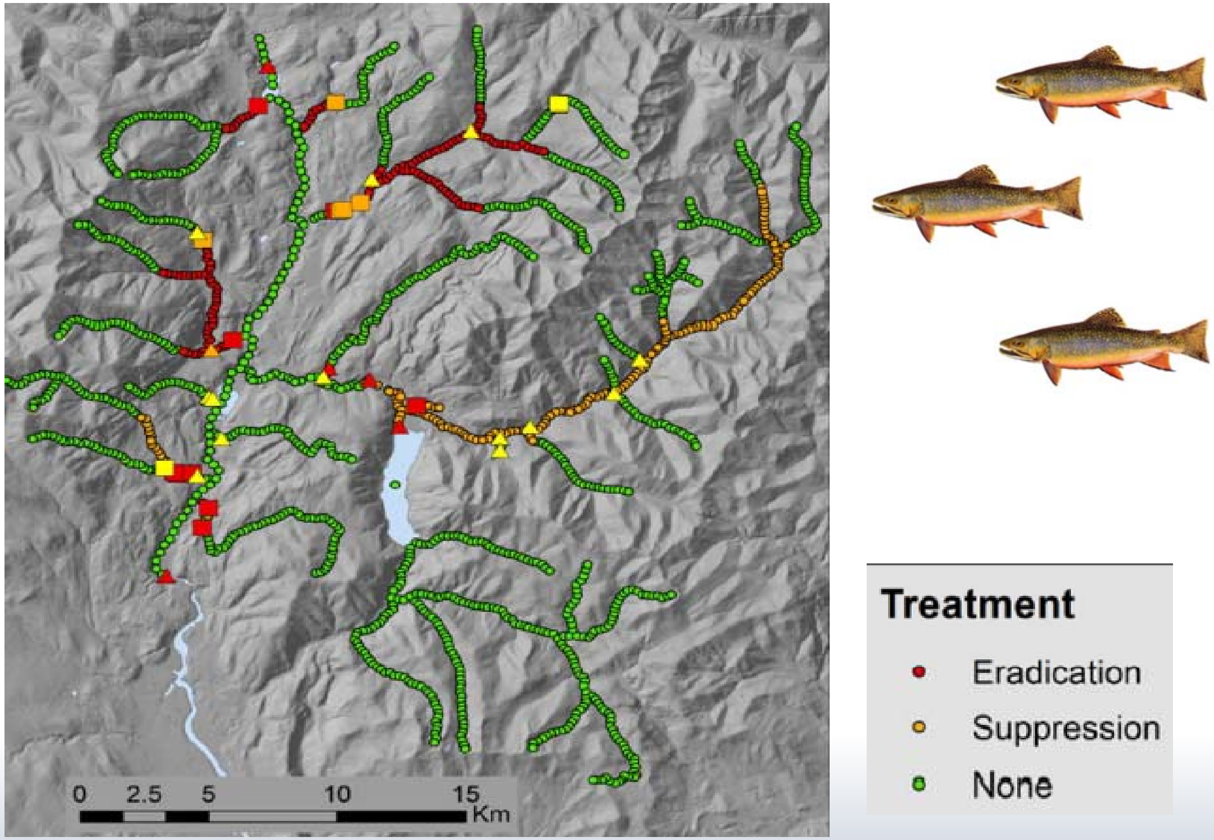

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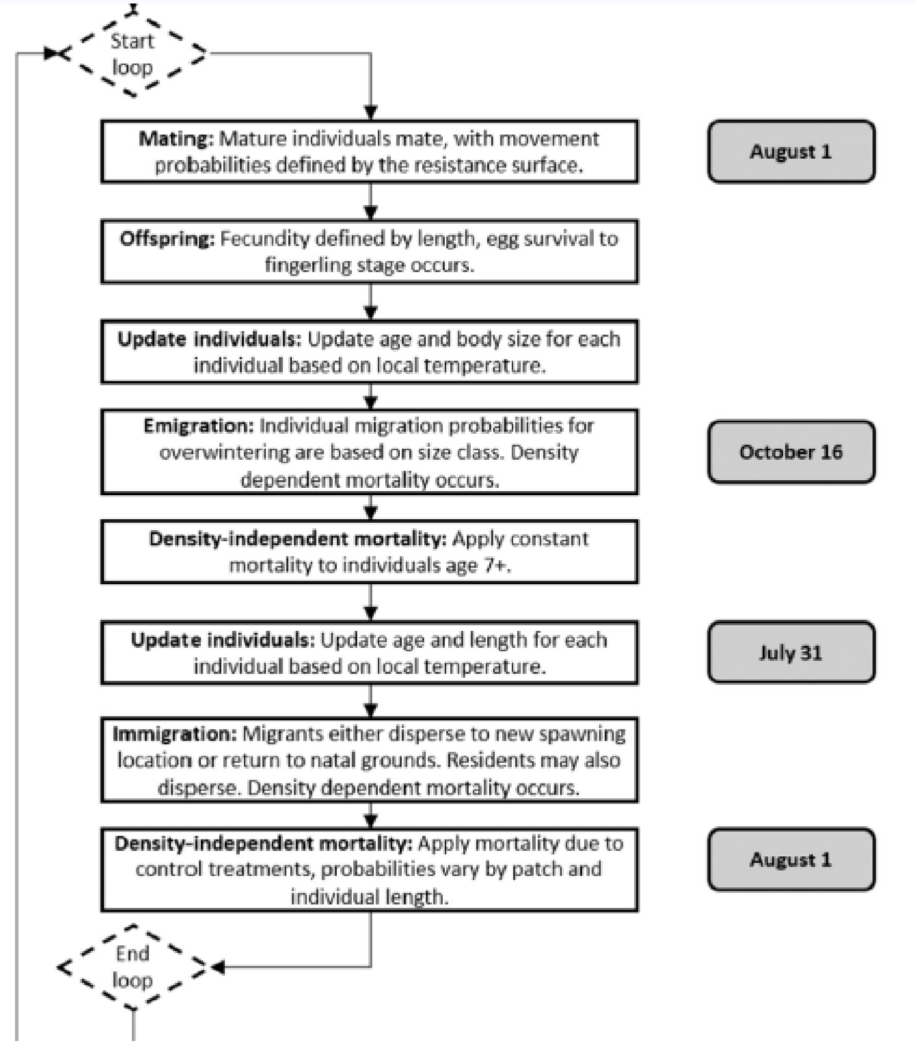


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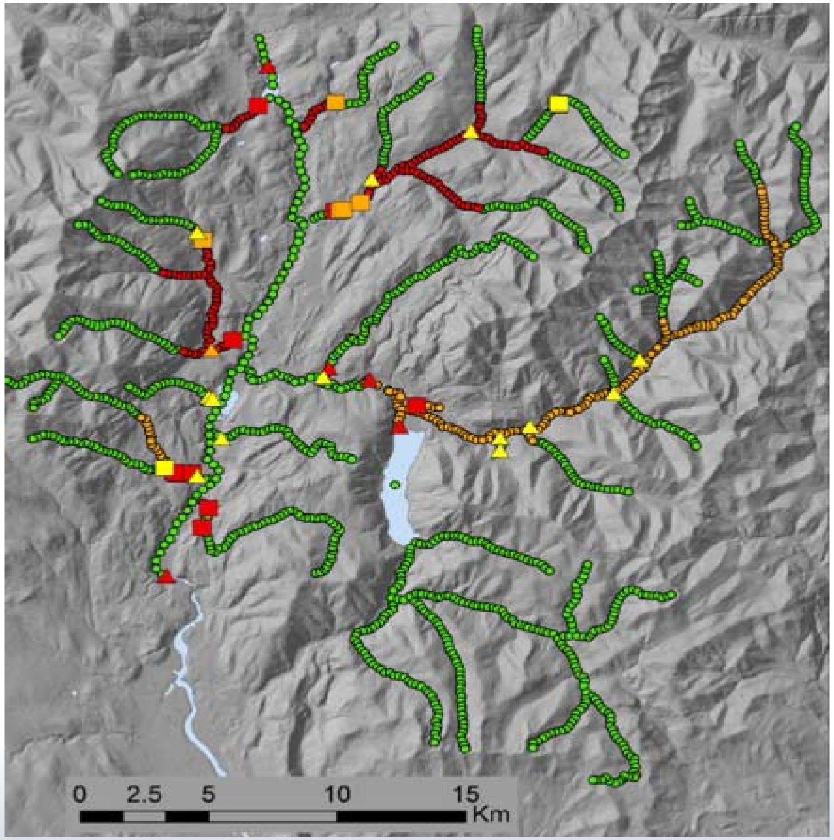


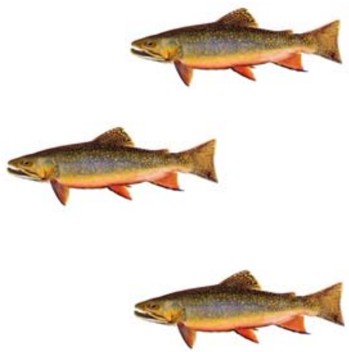

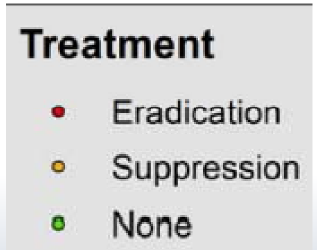

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Acknowledgments:

- ISPRA and the organizers of the event
- University of Angers and Life CROAA
- Centre of Excellence for Invasion Biology
- Dr Jean Secondi
- Dr John Measey and Dr Sarah Davies
- Prof. Dave Richardson and Prof. Cang Hui