Introduction to the R package `mobsim`

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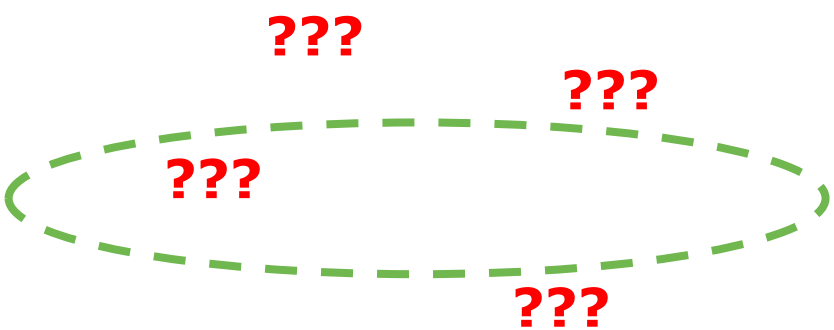
Original creator: Felix May

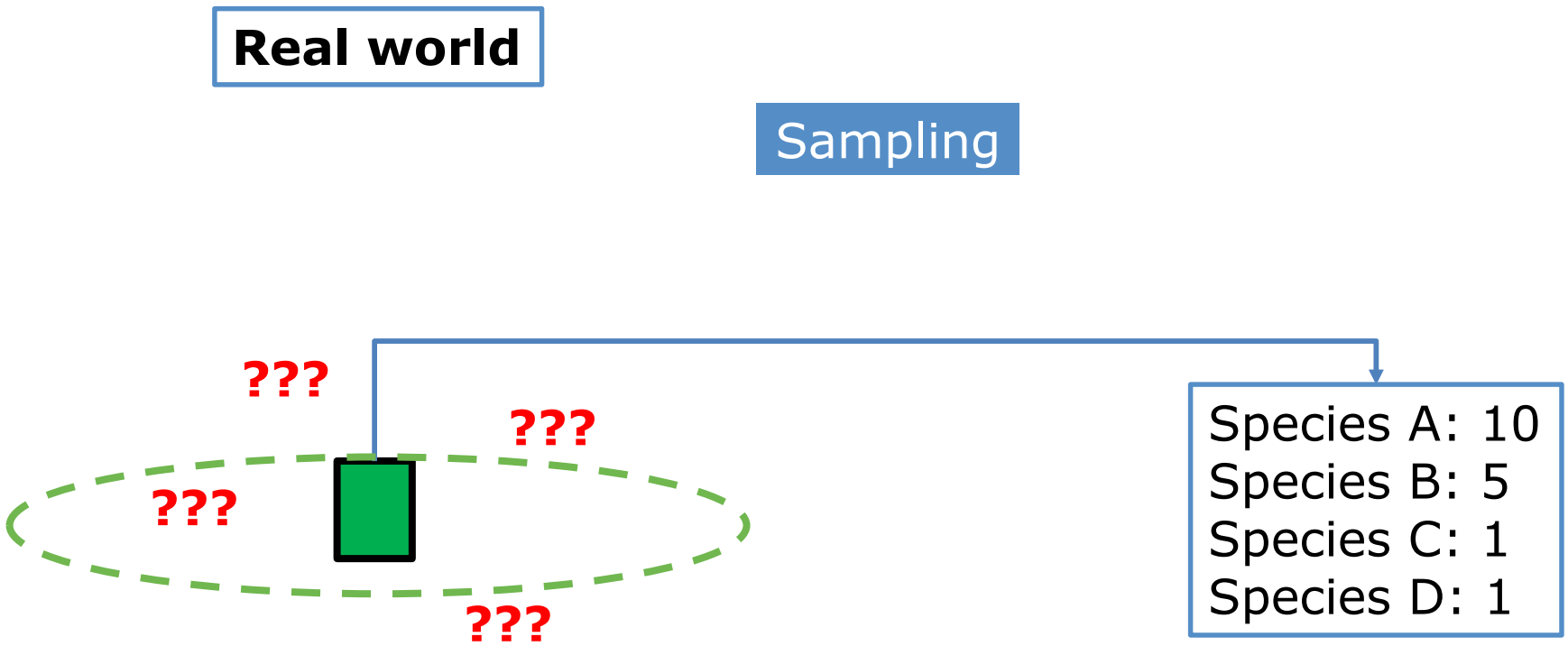
iDiv is a research centre of the DFG Deutsche Forschungsgemeinschaft

Biodiversity science

Real world



Biodiversity science



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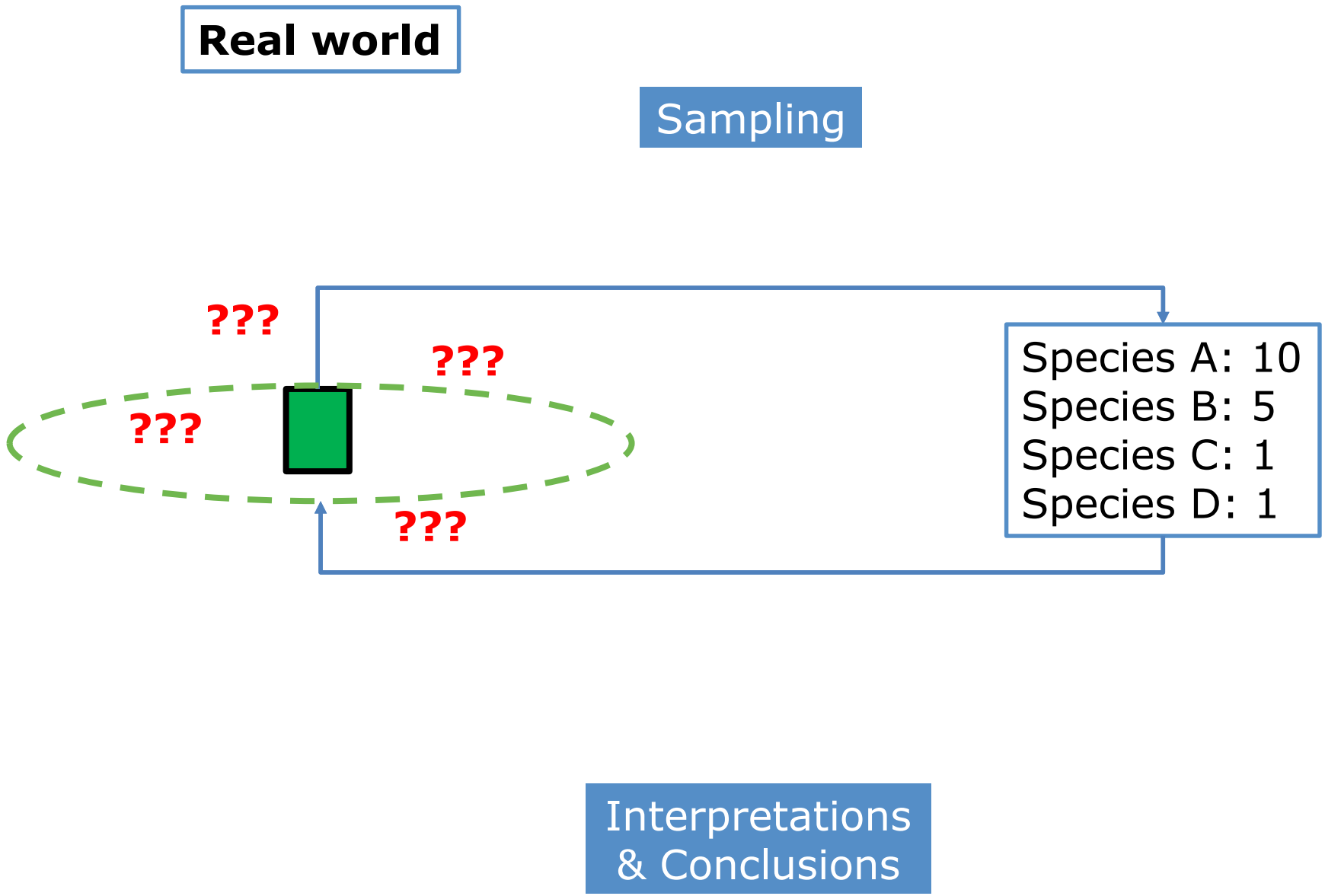

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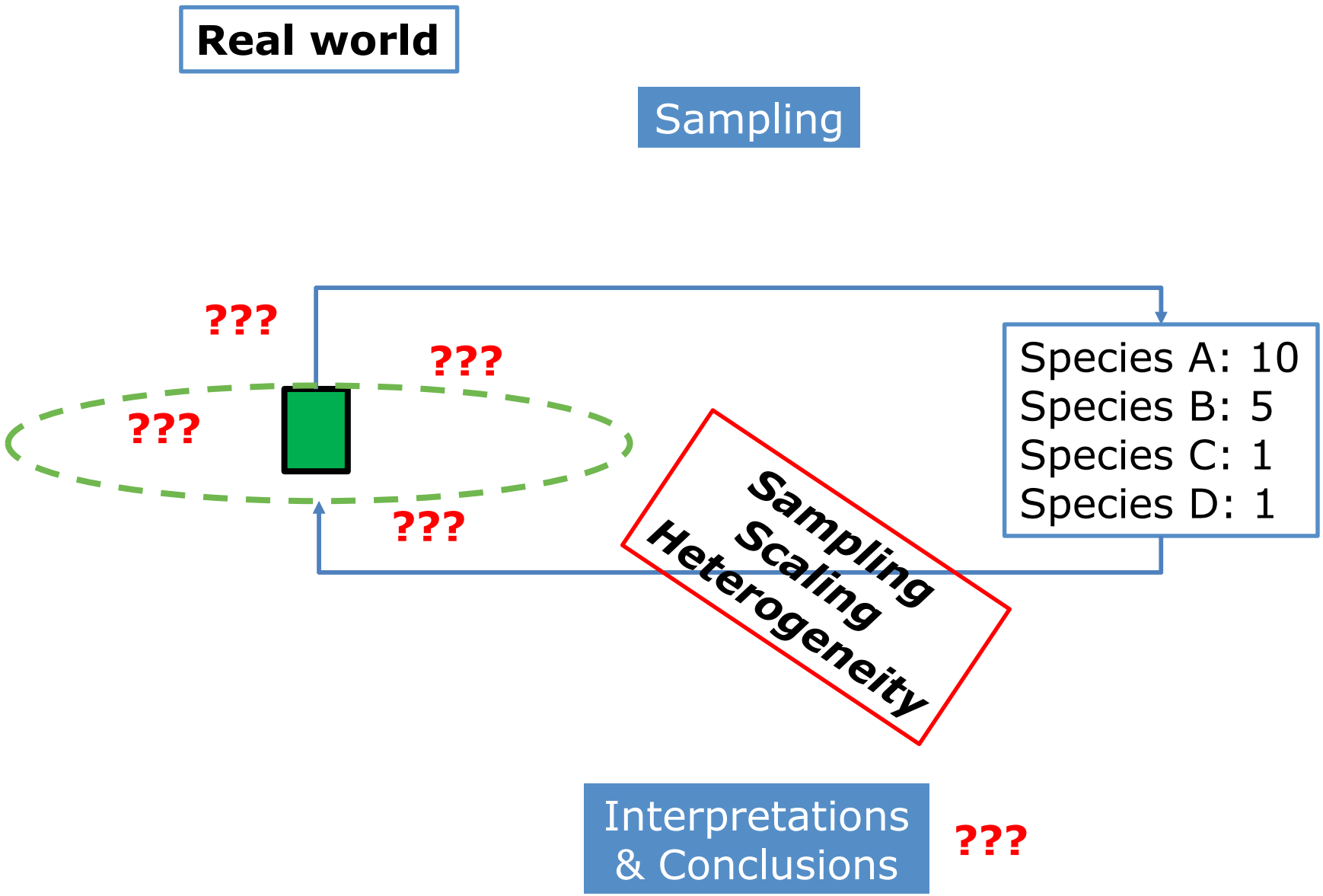
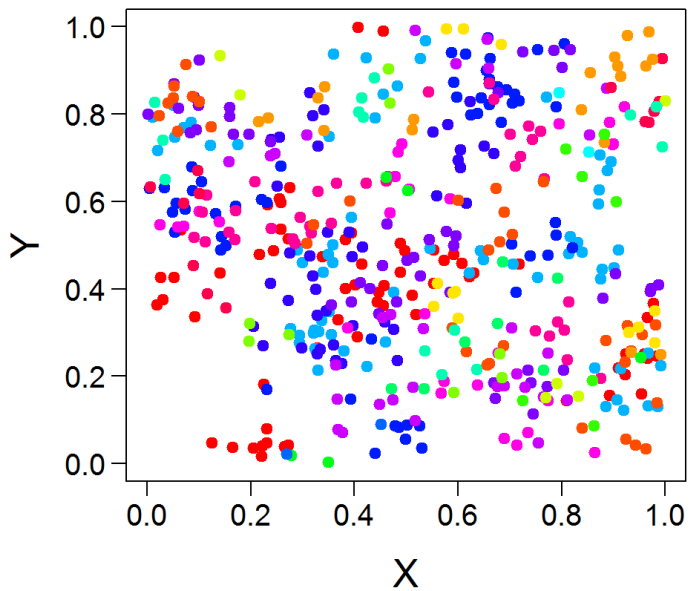


Learning from simulated data

Simulation: complete control



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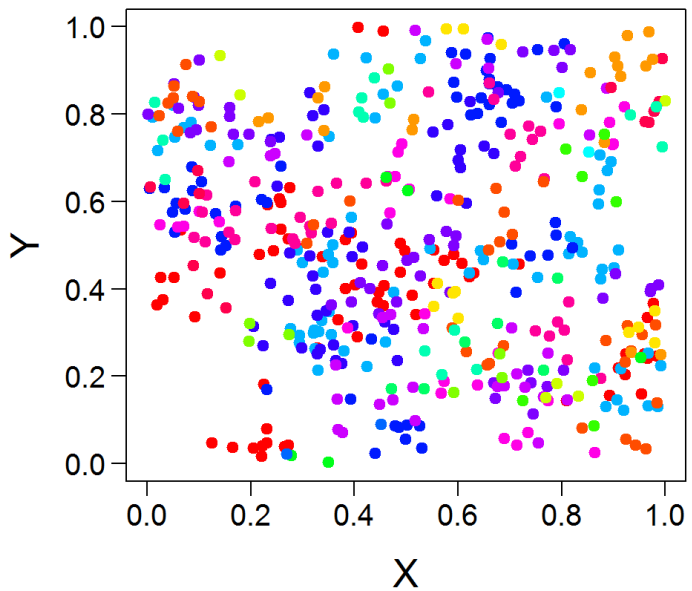
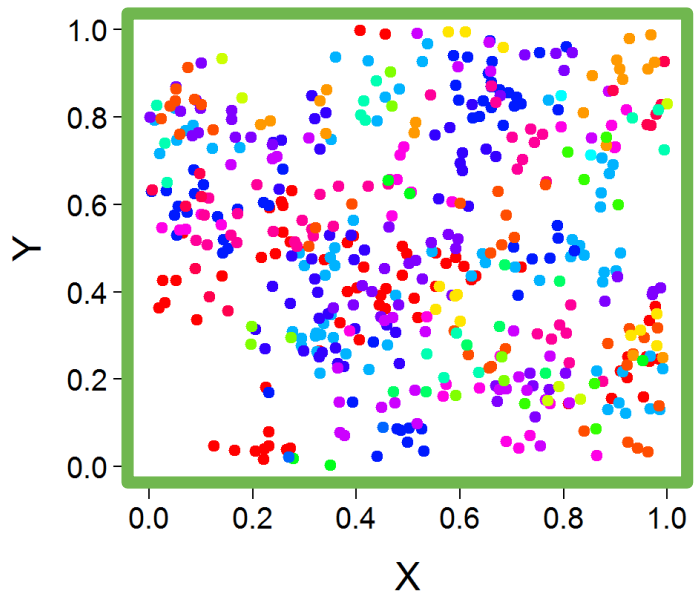


Change parameters

Test hypotheses

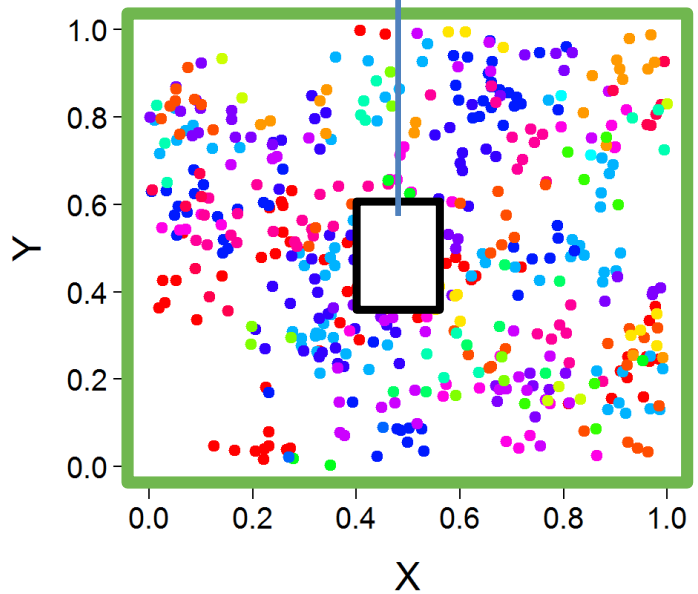
Learning from simulated data

Simulation: complete knowledge



Learning from simulated data

Simulation: complete knowledge

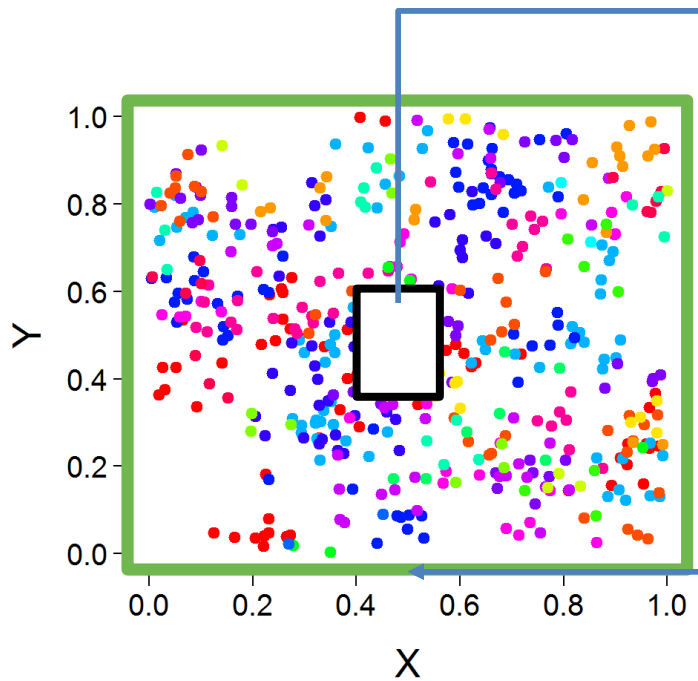


Sampling

Species A: 10
Species B: 5
Species C: 1
Species D: 1

Learning from simulated data

Simulation: complete knowledge



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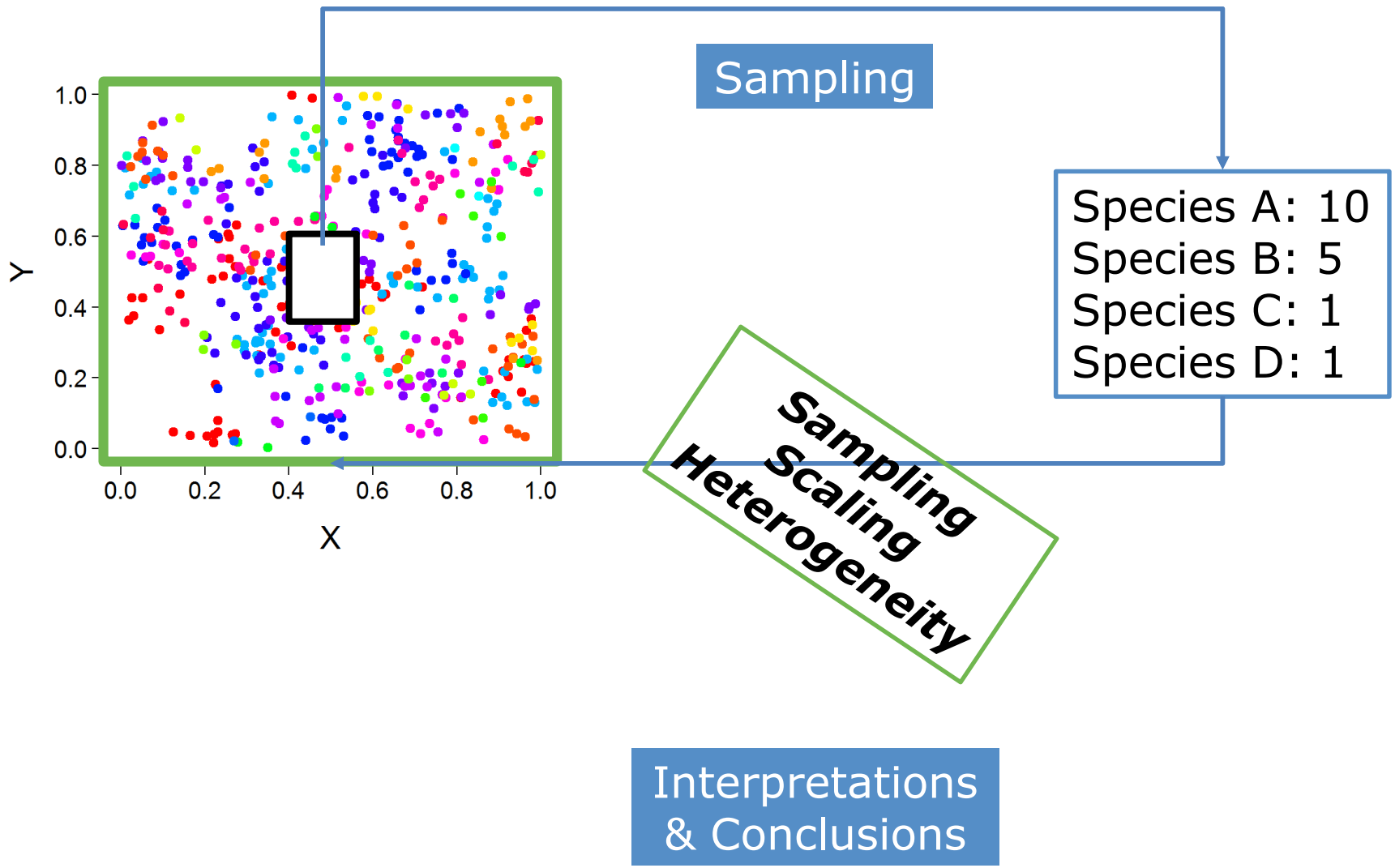
Interpretations & Conclusions

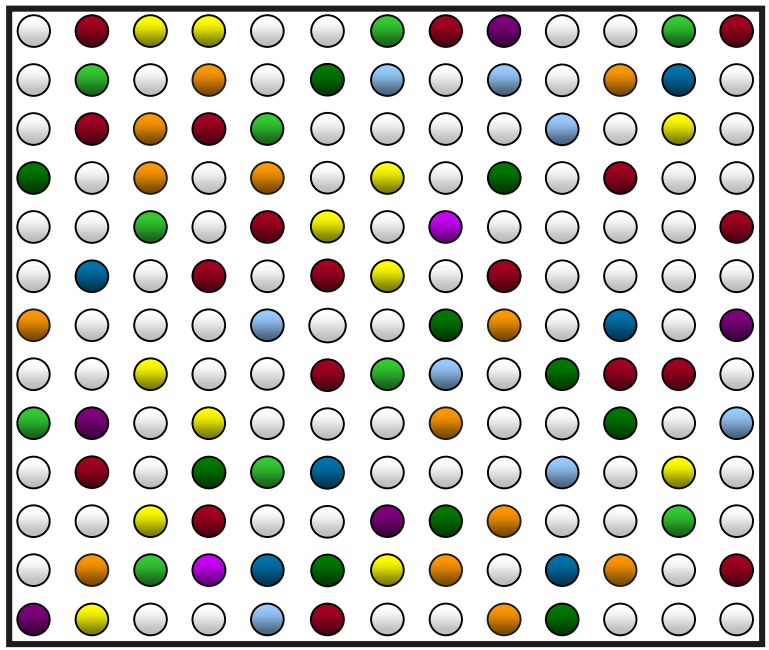
Learning from simulated data

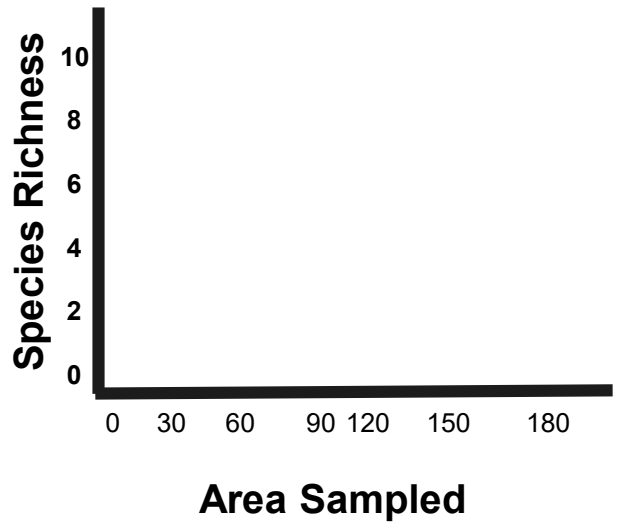
Simulation: complete knowledge



Scale and Sampling effect on Species Area Relationships

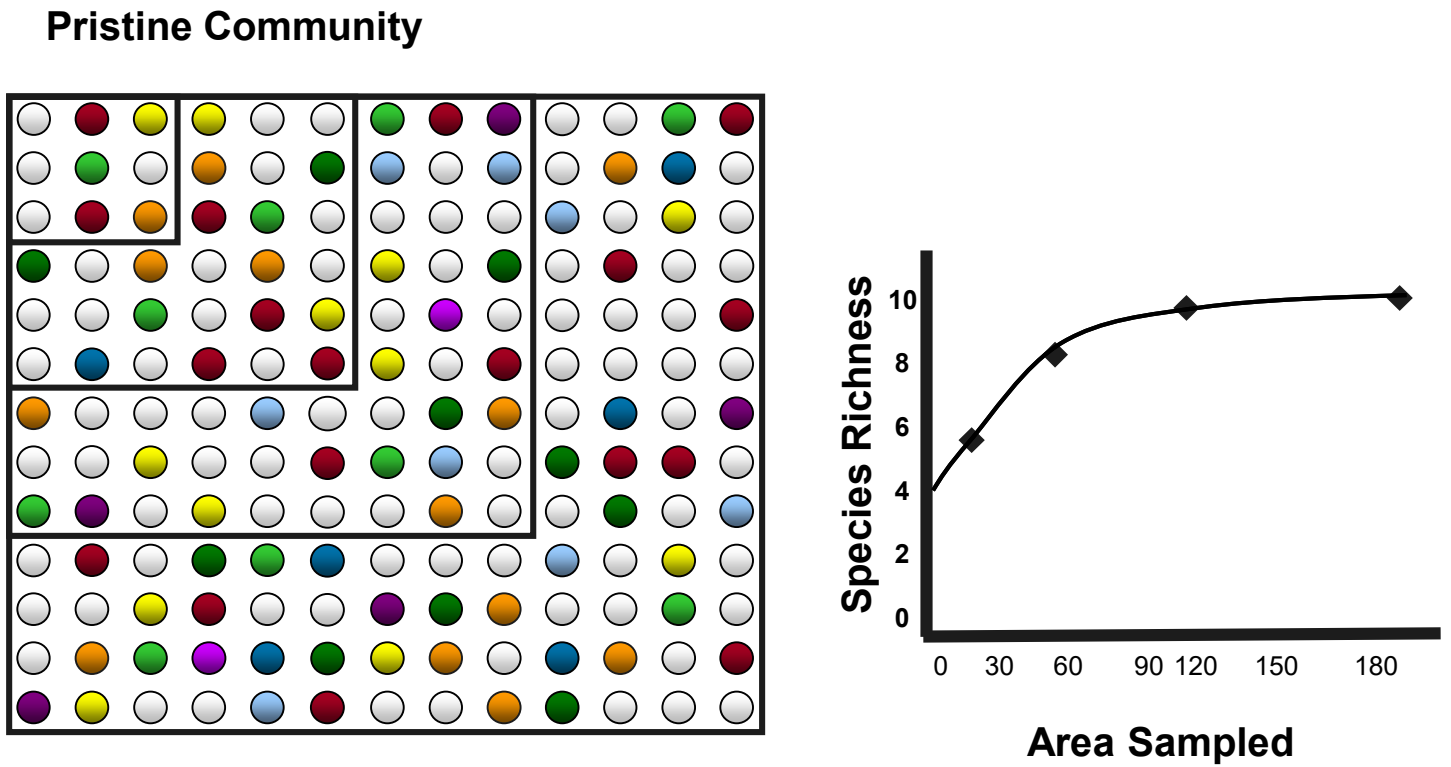
Pristine Community





Chase and Knight 2013 Ecology Letters

Scale and Sampling effect on Species Area Relationships



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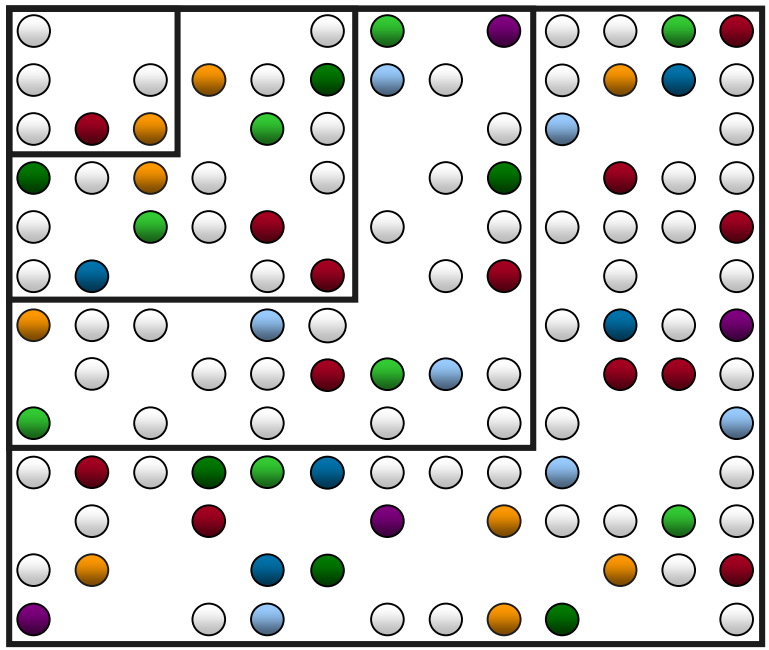
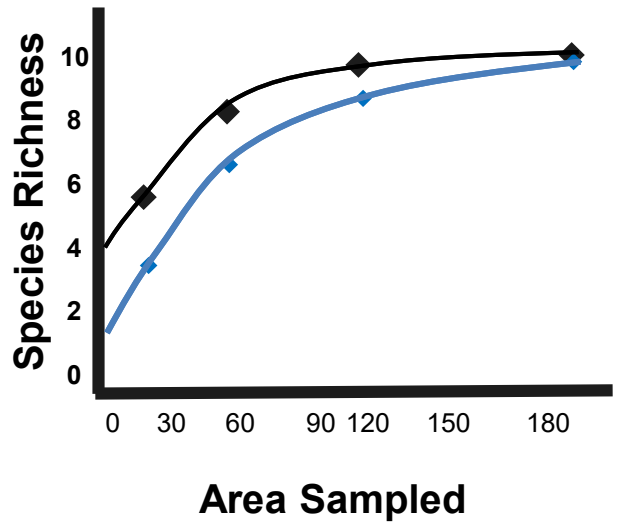
Degraded Community





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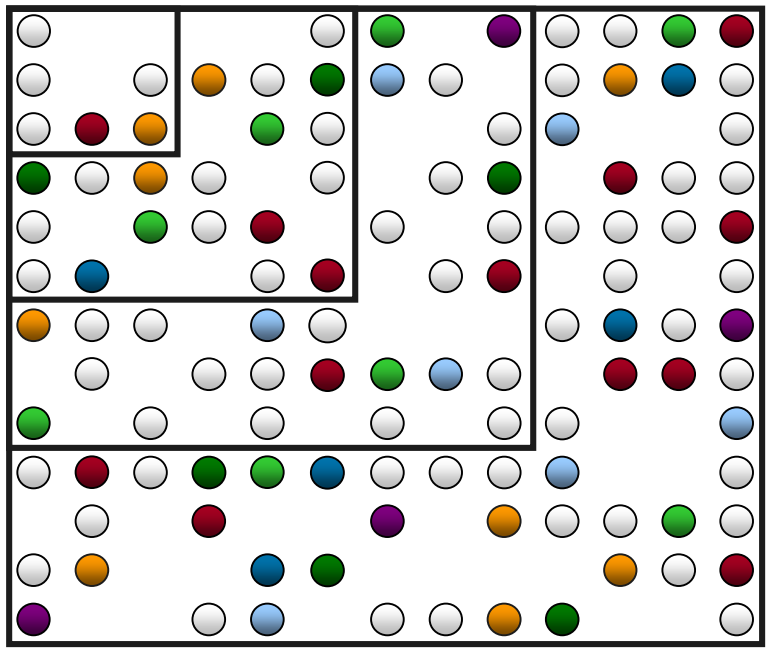
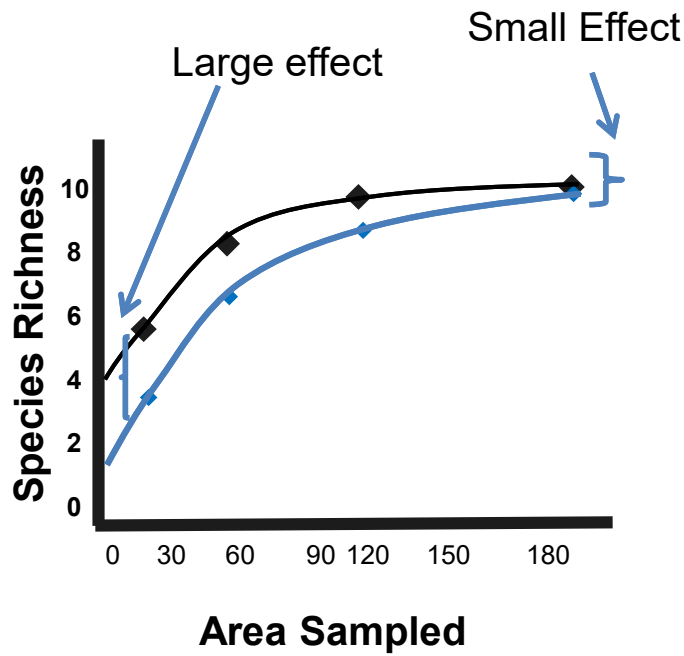
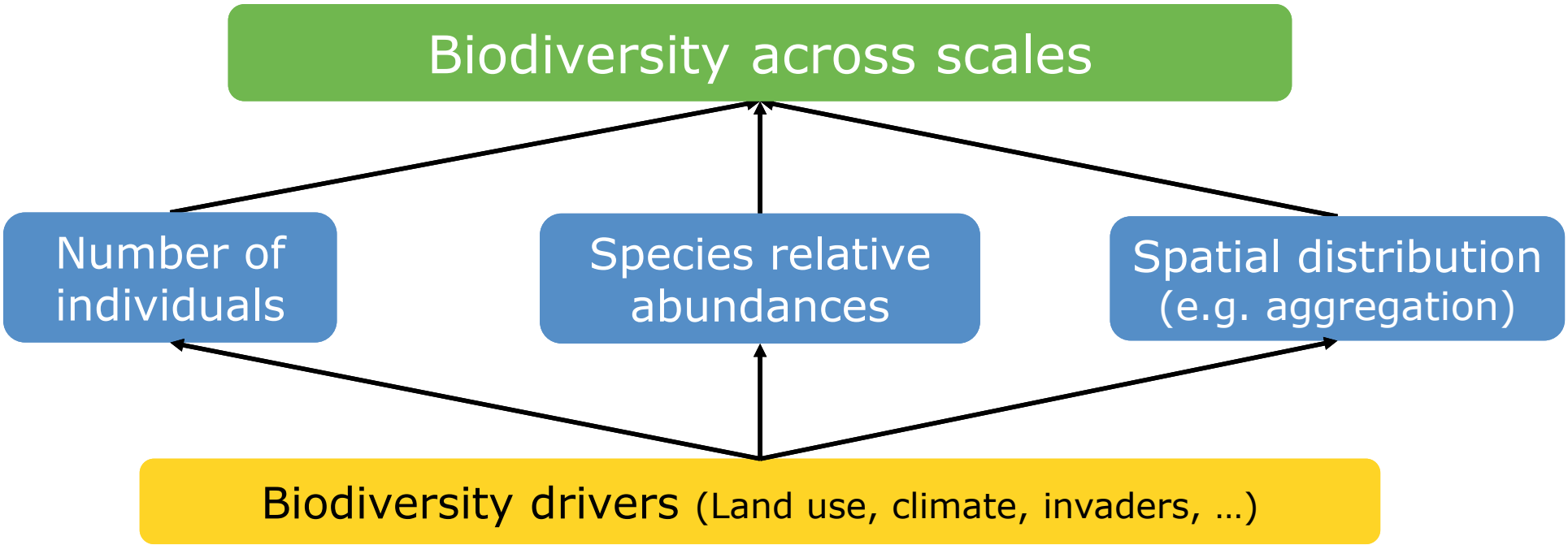
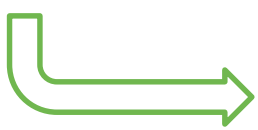




Chase and Knight 2013 Ecology Letters

Spatial analysis of scale-dependent biodiversity changes





package **mobsim**

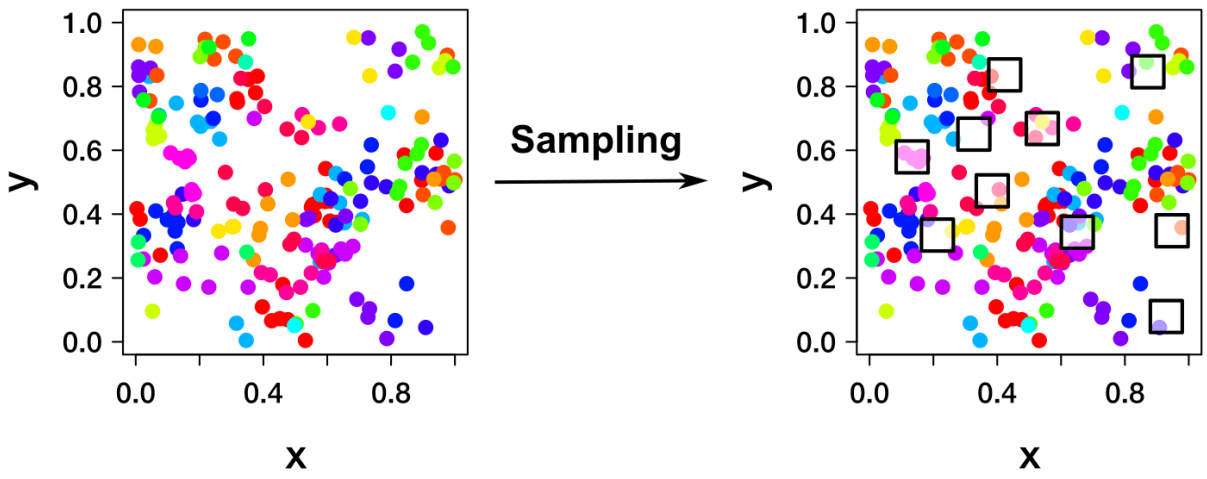
Species Abundance Distribution (SAD)
- No. of individuals
- No. of species
- Evenness

Species clumping
- Cluster extent
- No. of clusters
- Individuals per cluster

package **mobsim**

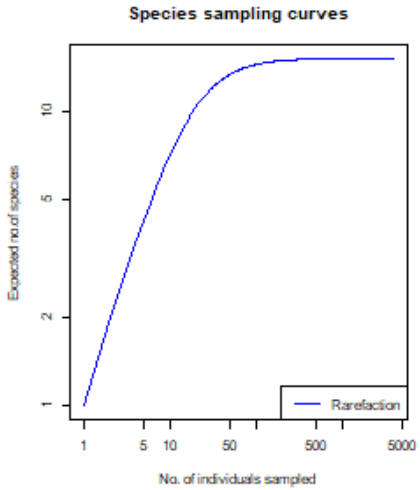
https://github.com/MoBiodiv/mobsim

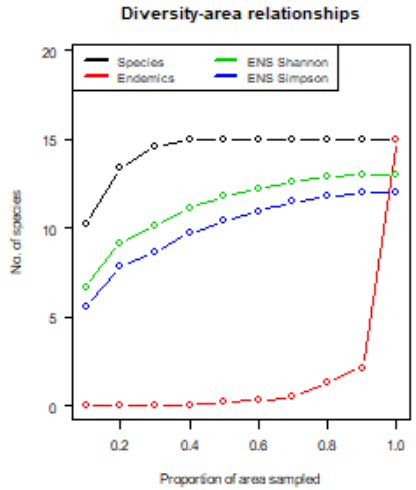
Simulation

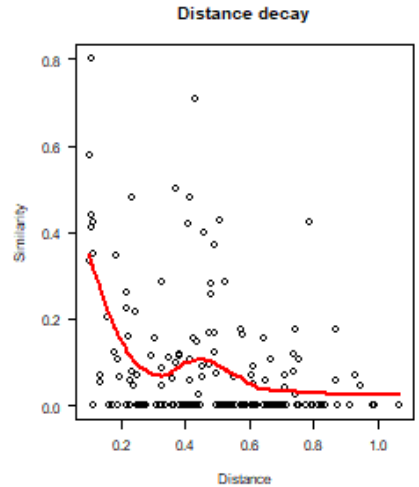


Sampling

Analysis **Analysis**







Aims

- Interactive illustration of Measures of Biodiversity
- Sensibilization to their sensitivity to sampling
- Showing the shiny MOBsim and feedback

Exercise #1: Biodiversity components

5+5 minutes

- Imagine a realistic community
  - Forest, bushes, prairie, (ants and termites, small mammals), etc

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  - Total abundance (N)
  - Species abundance distribution (SAD)

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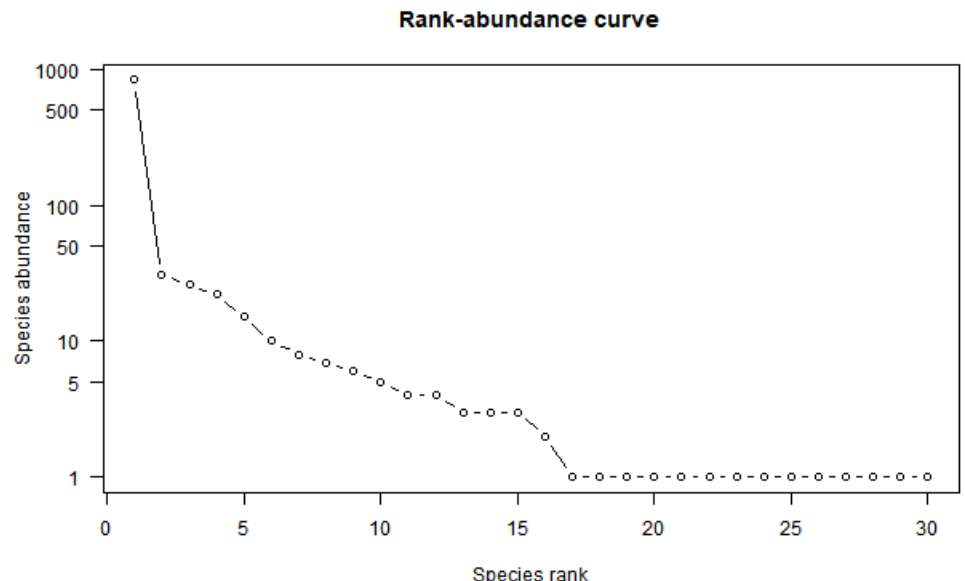
1. **Draw your expectations** for the rank abundance curve with pen and paper



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1. **Draw your expectations** for the rank abundance curve with pen and paper
2. Use `mobsim: 1 SAD - Population simulation` to simulate this community
3. Get familiar with the different SAD types and their parameters
4. **Verify your expectations**

Exercise #2: Biodiversity spatial distribution

5+5 minutes

- Imagine a realistic spatial distribution for your community
  - Intraspecific aggregation (clumping)
    - Number of mother points
    - Mean distance to mother points

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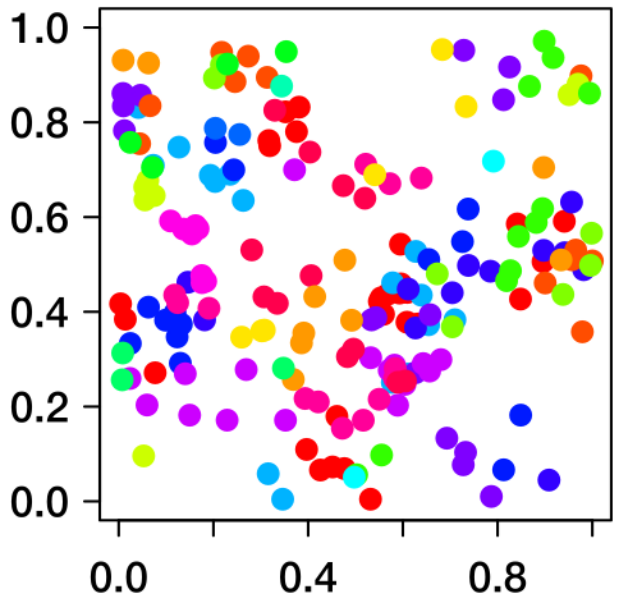

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1. **Draw or describe your expectations** as a map (one dot = one individual)
2. Use `mobsim: 2 Space - Distribution simulation` to simulate this community
3. Get familiar with the different cluster types and their parameters. Try giving different parameter values to the species.
4. **Verify your expectations**

Exercise #3: Biodiversity components

15 minutes

- How do biodiversity components
  - Total abundance (N)
  - Species abundance distribution (SAD)
  - Intraspecific aggregation (clumping)
- Influence the measured biodiversity
  - Rarefaction curve (`mobsim::spec_sample_curve()`)
  - Species-area relationship (`mobsim::divar()`)

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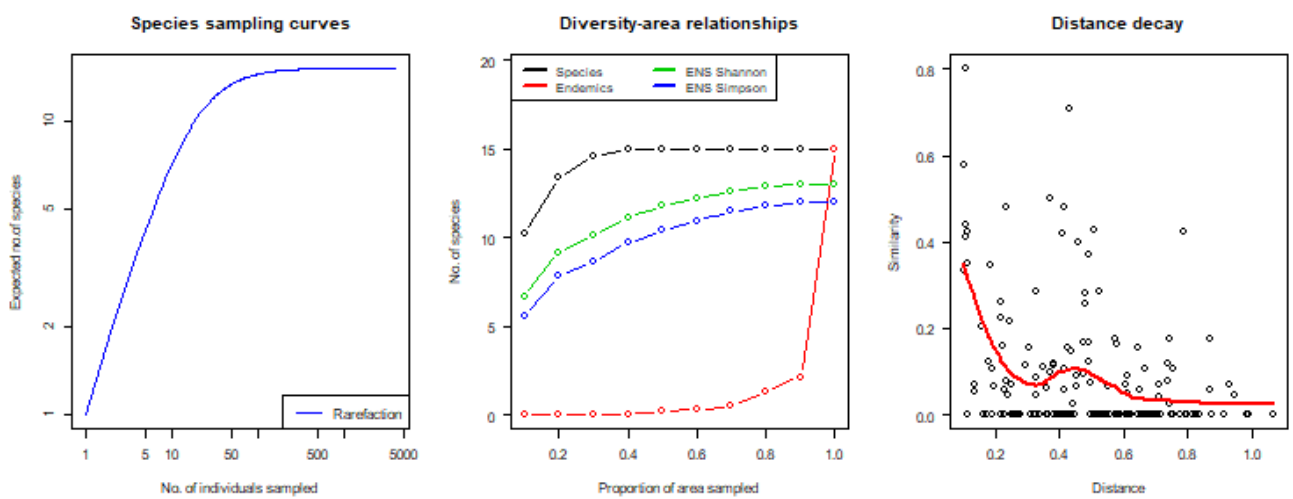

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1. **Draw your expectations** with pen and paper
2. Use `mobsim: 2 Space - Distribution simulation [Exercise 3]` to familiarize with these graphical representations of biodiversity sampling tools
3. **Verify your expectations + ecological interpretation**

Exercise #3 part 2: Biodiversity components & Biodiversity scaling-relationships 15 minutes

- How do biodiversity components
  - Total abundance (N)
  - Species abundance distribution (SAD)
  - Intraspecific aggregation (clumping)
- **And sampling**
- Influence the measured biodiversity
  - Rarefaction curve (`mobsim::spec_sample_curve()`)
  - Species-area relationship (`mobsim::divar()`)

1. **Draw your expectations** with pen and paper
2. Use `mobsim: 3 Basic Sampling` to familiarize with the sampling tools
3. **Verify your expectations + ecological interpretation**
4. **What is the best sampling design? Why?**
5. Briefly present your results to the group

Exercise #4: Detection of biodiversity changes across scales

- How is the detection of biodiversity changes influenced by the choice of sampling scale and biodiversity index?

1. Simulate two different communities
   a) Forest vs. Prairie. Forest (species poor, low densities (trees) mixed with clumped and abundant species (bushes and understory), etc) Vs. Prairie (species rich, high densities, low aggregation)
   b) Reference / control
   c) Biodiversity change
   d) Before vs. after a perturbation ; just after a perturbation vs. long after perturbation

2. Sample both communities in the same way (`mobsim::sample_quadrats()`)
   a) Apply different sampling designs: vary sample plot size, area and total sampling effort

3. Calculate relative biodiversity changes ($D_{ref}/D_{change} - 1$)
   a) Species richness (`vegan::specnumber`)
   b) Shannon diversity (`vegan::diversity`)
   c) Simpson diversity / PIE (`vegan::diversity`)

Exercise #4: Detection of biodiversity changes across scales

4. How do your conclusions on biodiversity change with sampling and index used?
5. What does that mean for biodiversity research?