Notes I

- Objective clearly visible
- Effect of environment on plants
- Replace derivative notation with temporal
- Emphesize that time <=> Y
- Put an input column as well
- Merge environment slides
- Remove genotype and mention env inputs
- Take-home message?

Institut de Recherche
en Informatique de Toulouse
CNRS - INP - UT3 - UT1 - UT2J

ReVa

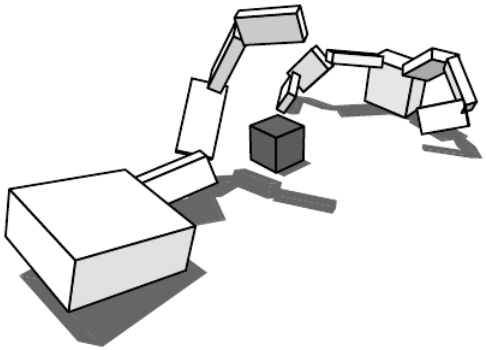
Speciation under changing environments

GODIN-DUBOIS Kevin & CUSSAT-BLANC Sylvain

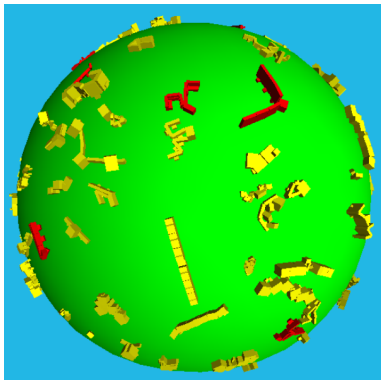
& DUTHEN Yves

August 2, 2019

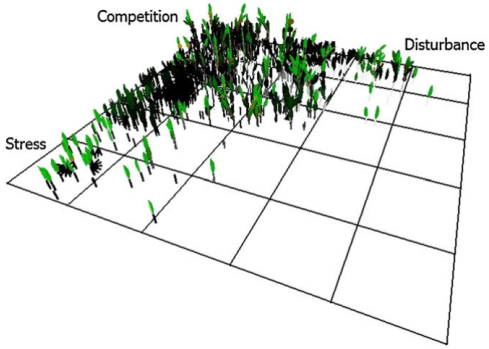
Context



Sims (1994)



Miconi (2008)



Bornhofen et al. (2011)

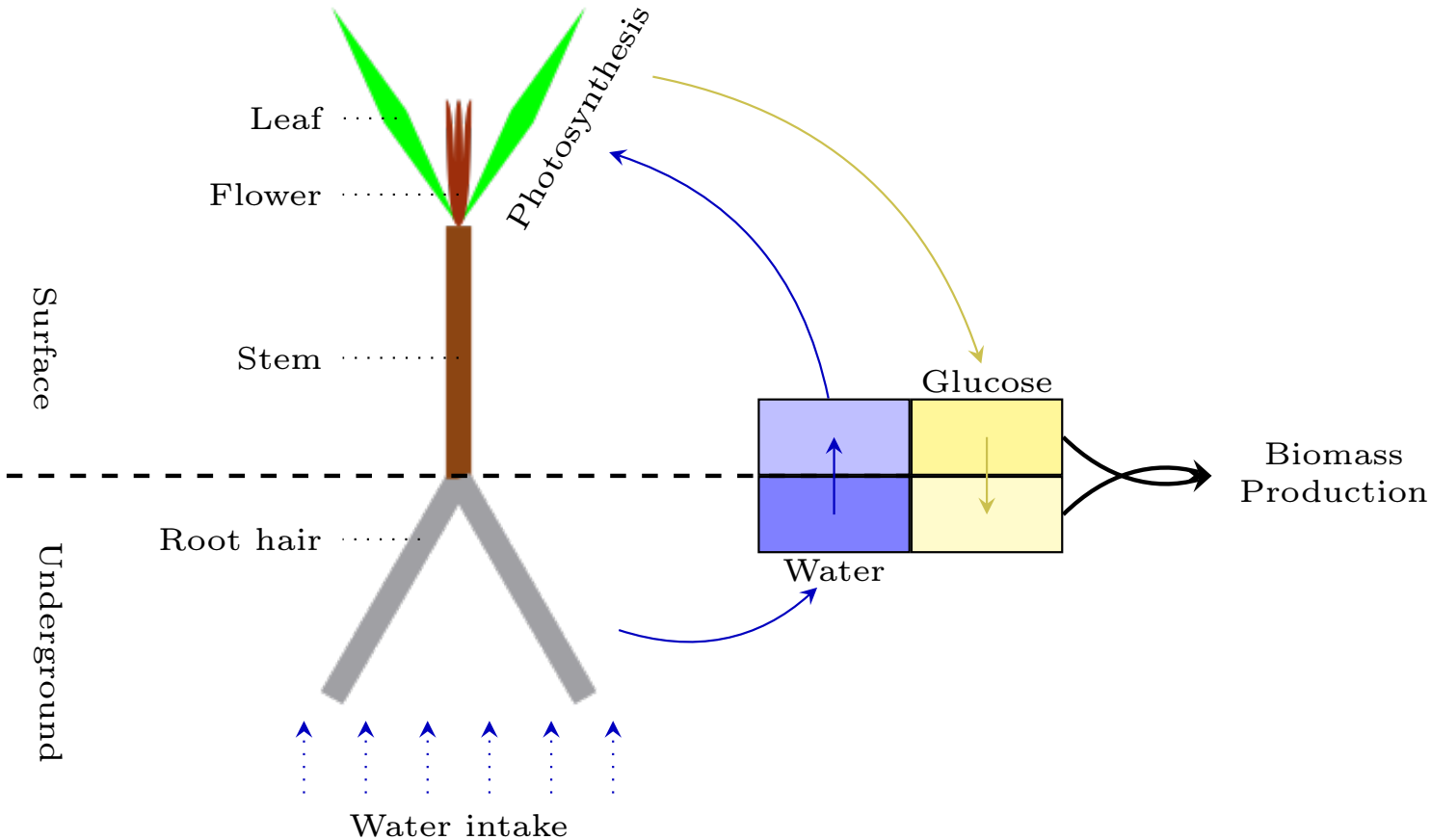
- Decades of Artificial Creatures
- Environments often smooth and static

Objective

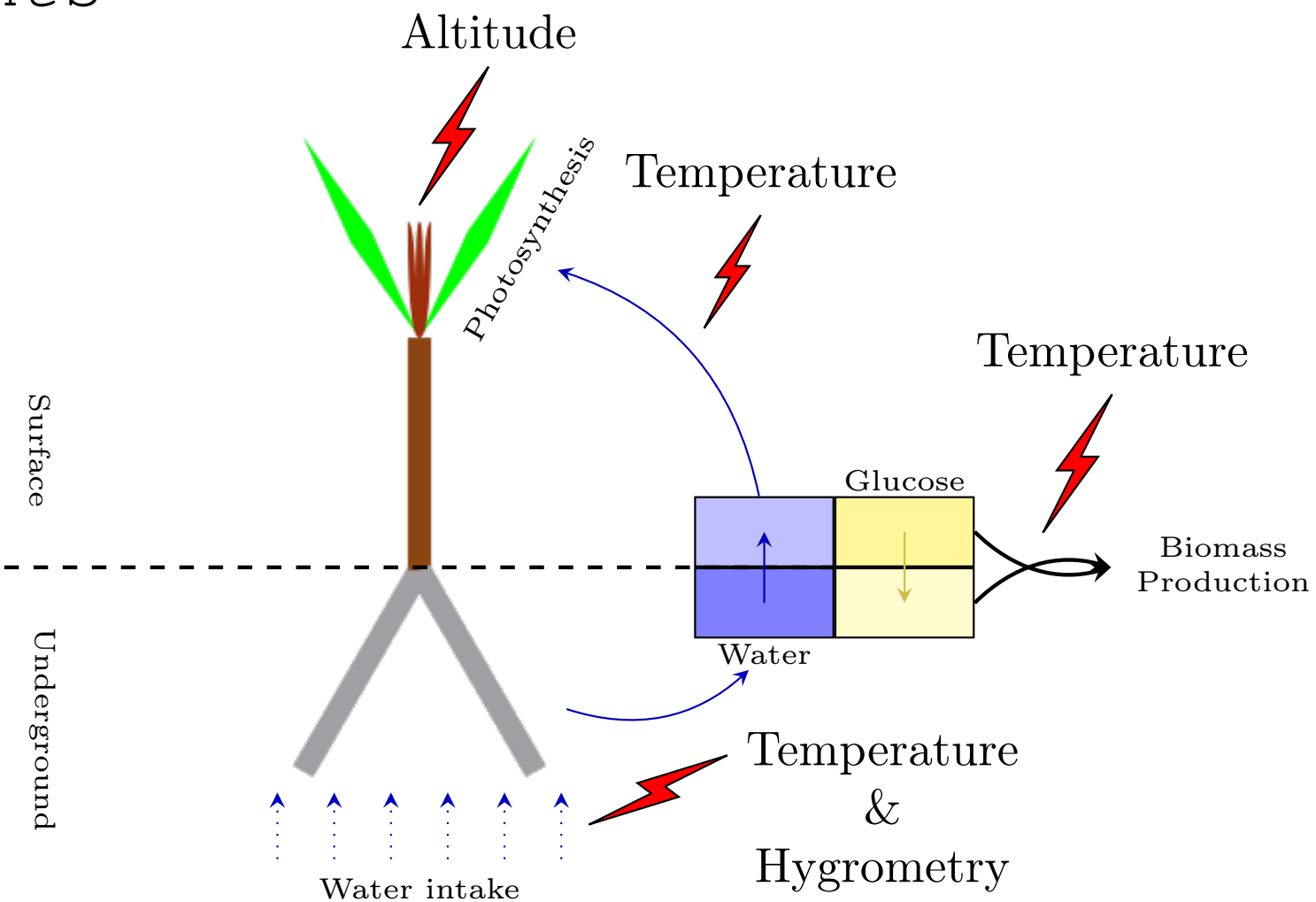
Pushing complexity further through the environement

- Forewords
- Model
  - Plants
  - Reproduction
  - Environment
  - APOGeT
- Experiment

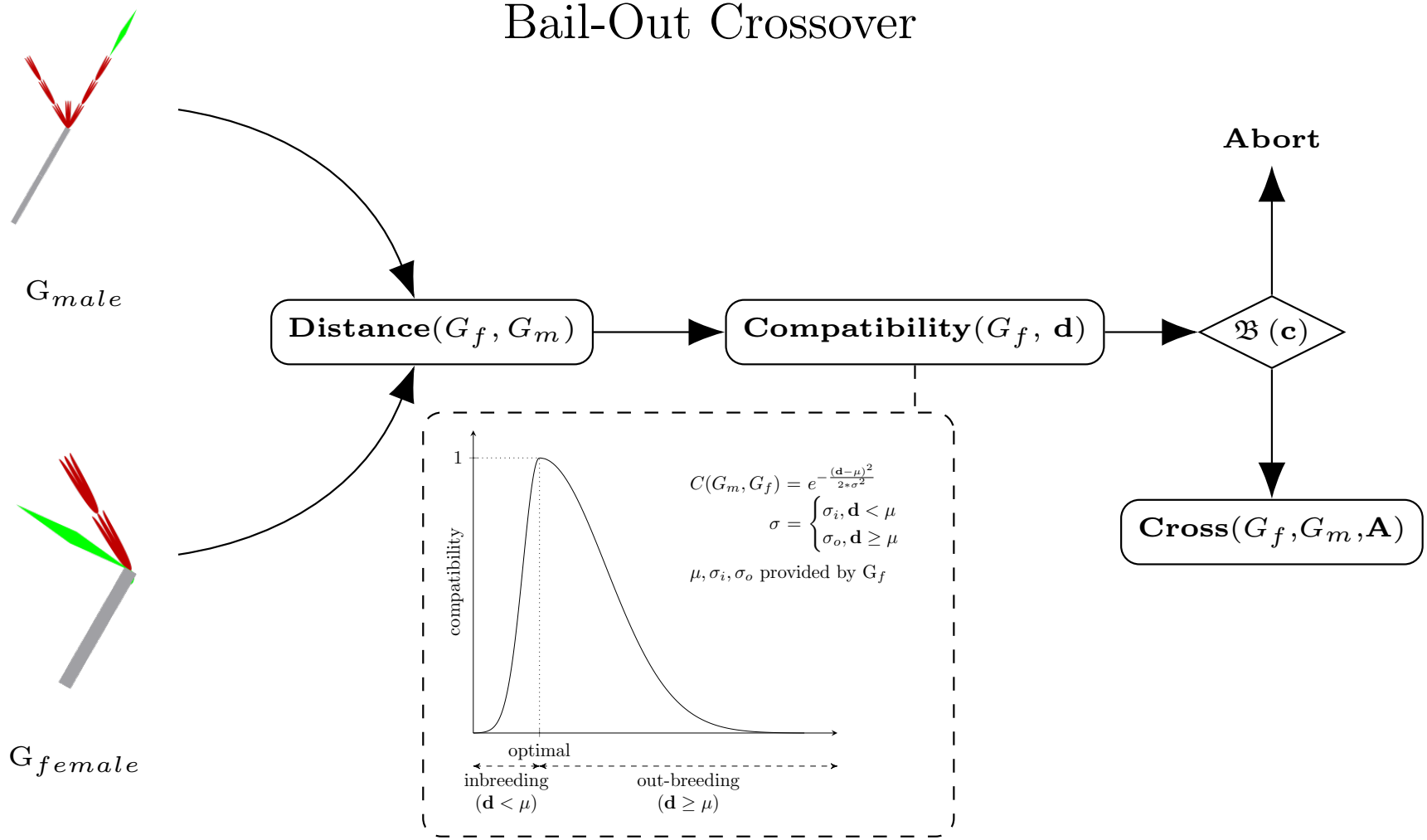
Plants


Leaf
Flower
Stem
Root hair
Surface
Underground
Photosynthesis
Glucose
Water
Biomass
Production
Water intake

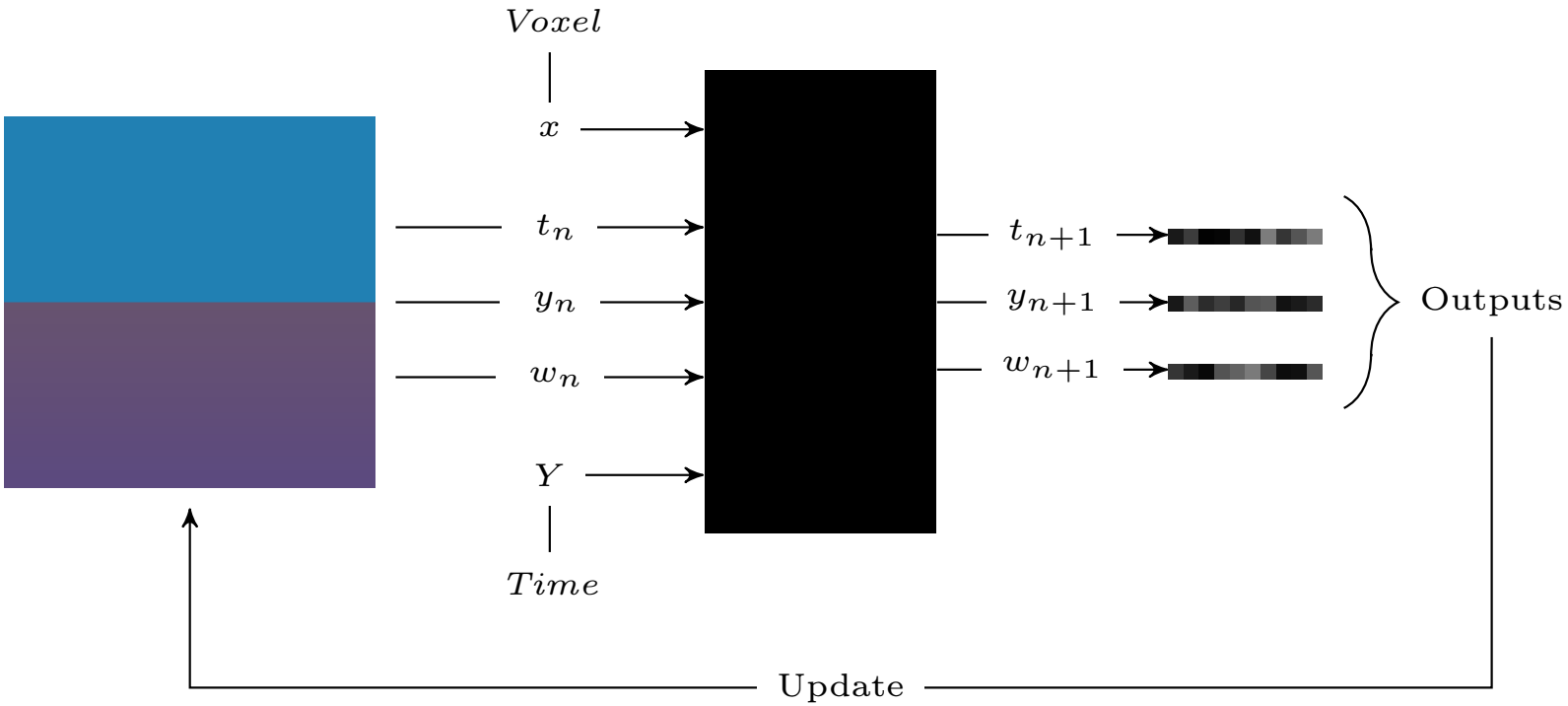
Plants


Altitude
Photosynthesis
Temperature
Temperature
Surface
Underground
Glucose
Biomass
Production
Water
Temperature
&
Hygrometry
Water intake

Reproduction



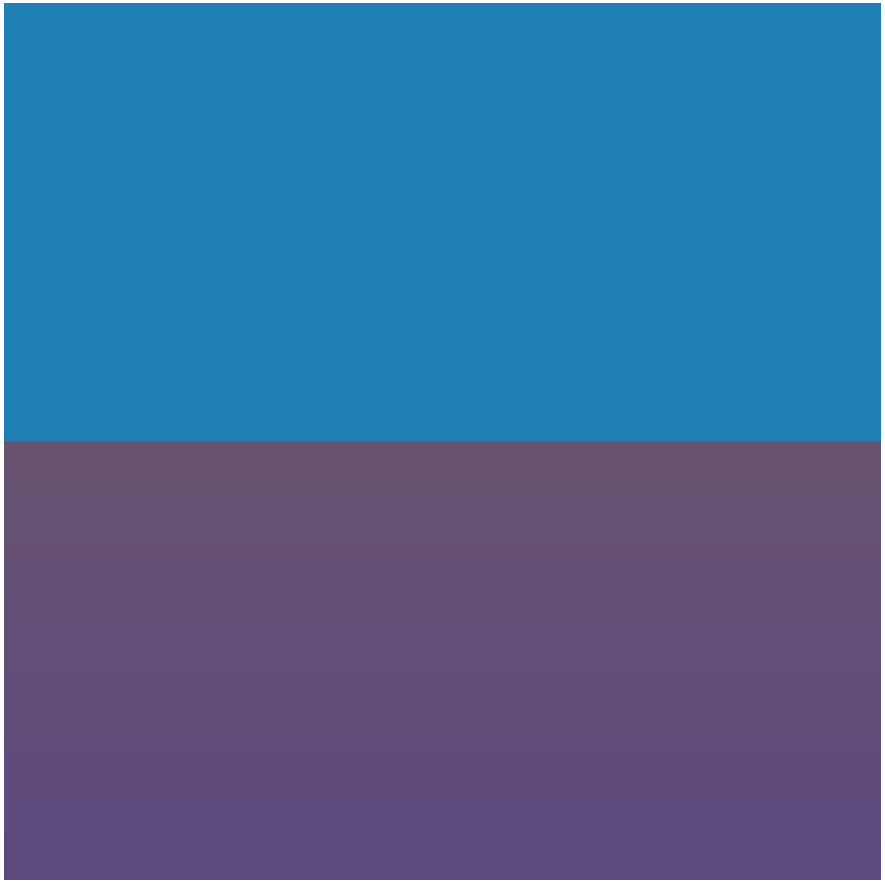
Environment



Environment

e.g.

$$
\begin{aligned}
c &= sin(Y\pi) \\
y_{n+1} &= .5sin(3x\pi)c \\
t_{n+1} &= 2(x - .5)c \\
w_{n+1} &= 2(.5 - x)c
\end{aligned}
$$



APOGeT

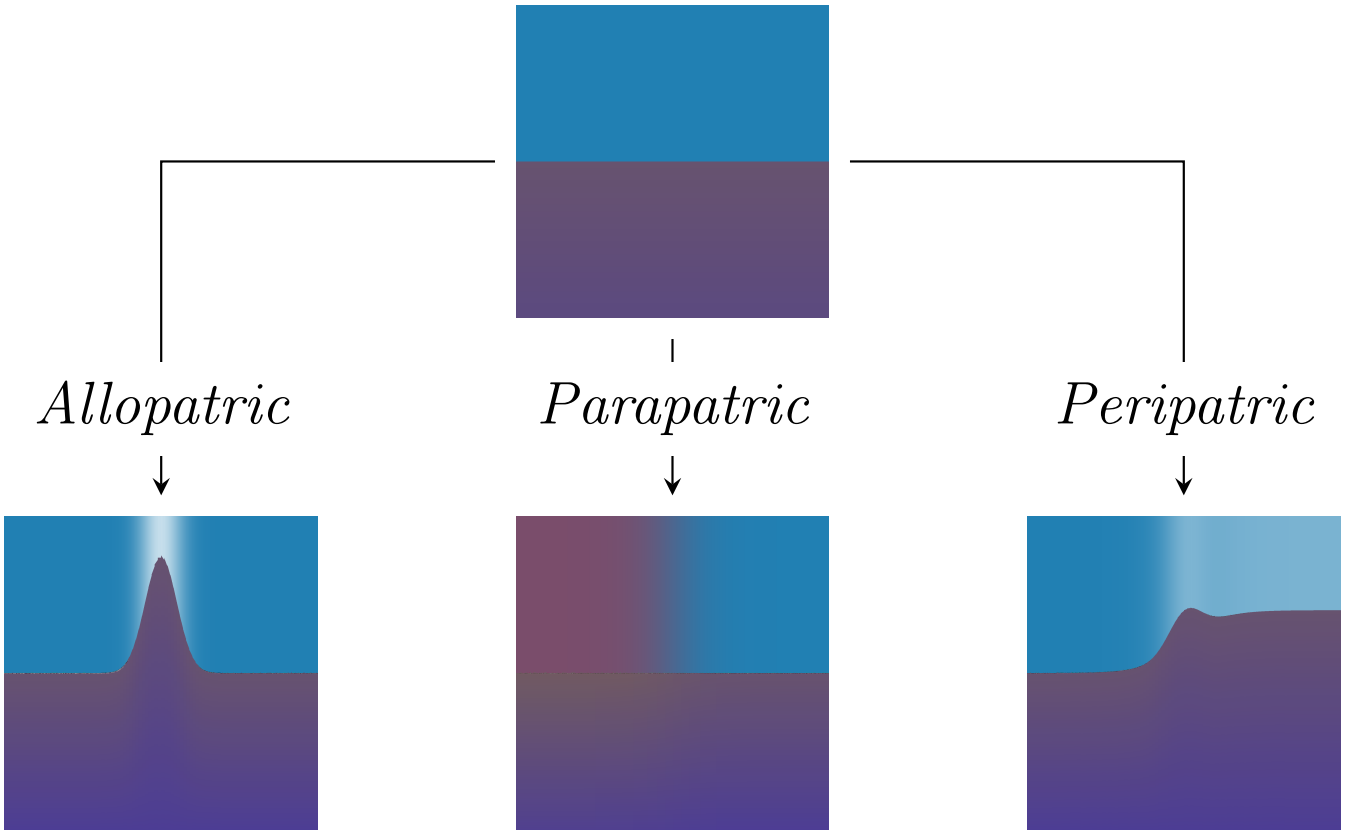
Genome clustering tool for on-the-fly species delimitation.

- Compatibility metric: $\mathbf{G}^2 \rightarrow [0, 1]$
- Representatives set

- Forewords
- Model
- Experiment
  - Protocol
  - Validation
  - Dynamics

Protocol

- Minimalist, hand-crafted, test cases:



Validation

Inter-species compatibility

Absolute

$$c_a(A,B) = \frac{1}{|A||B|} \sum_{f \in A} \sum_{m \in B} f.compat(m)$$

Relative

$$c_r(A,B) = \frac{c_a(A,B)}{c_a(A,A)}$$

Validation

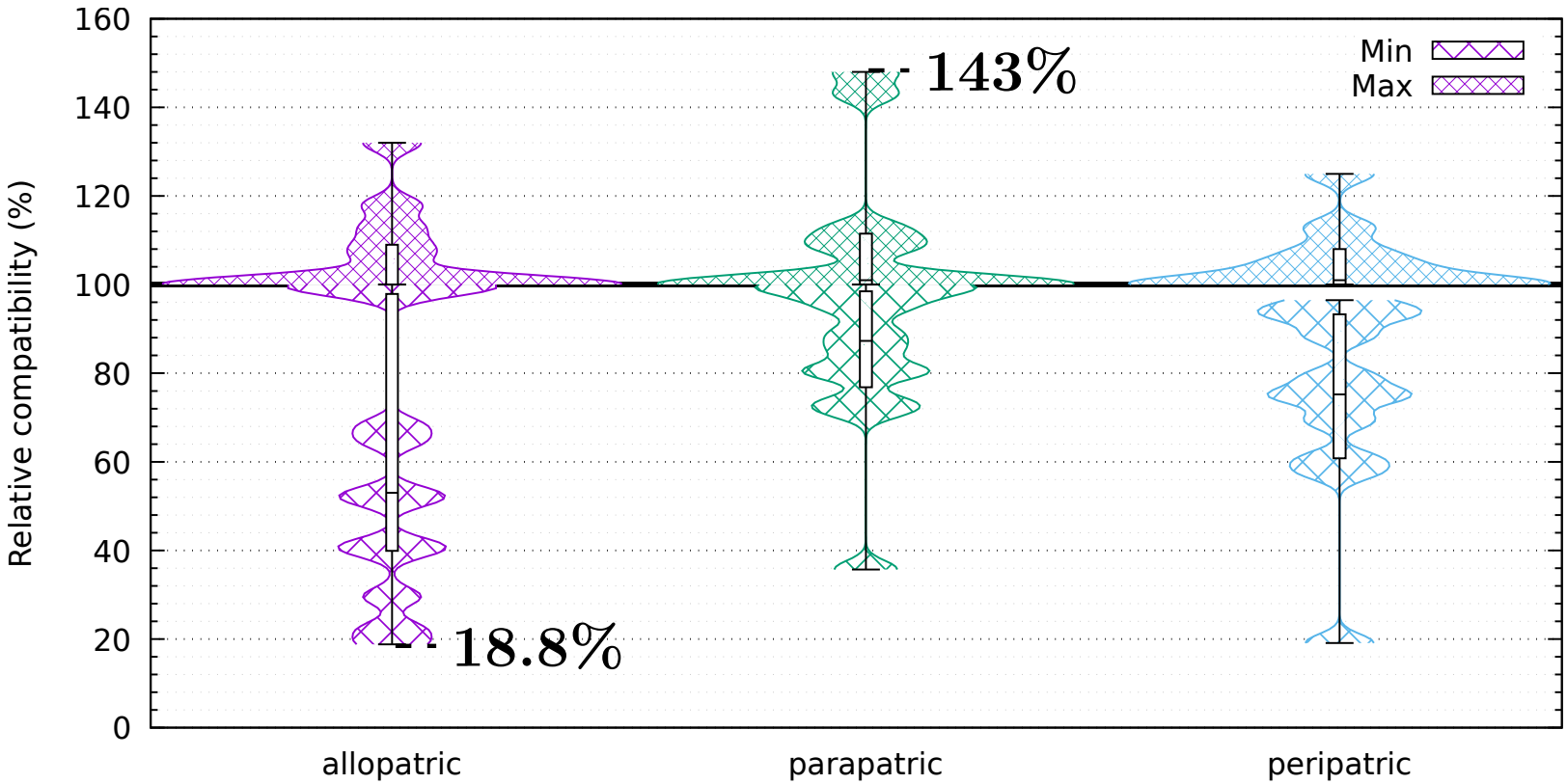
Inter-species compatibility

Absolute

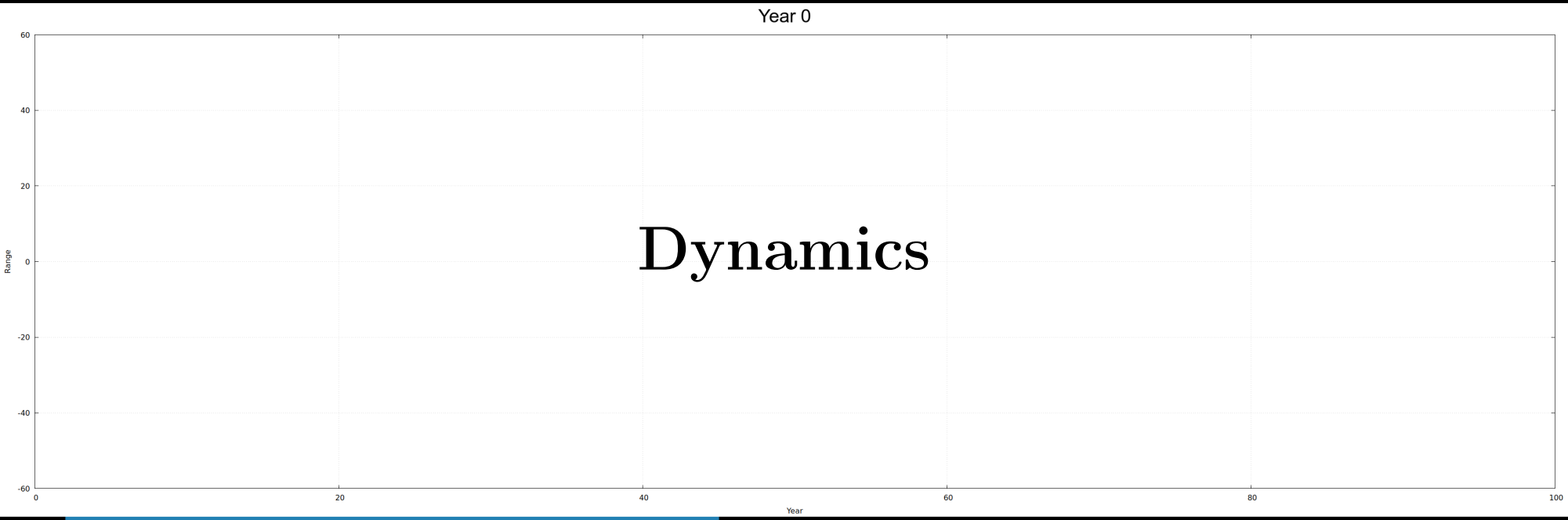
$$c_a(A,B) = \frac{1}{|A||B|} \sum_{f \in A} \sum_{m \in B} f.compat(m)$$

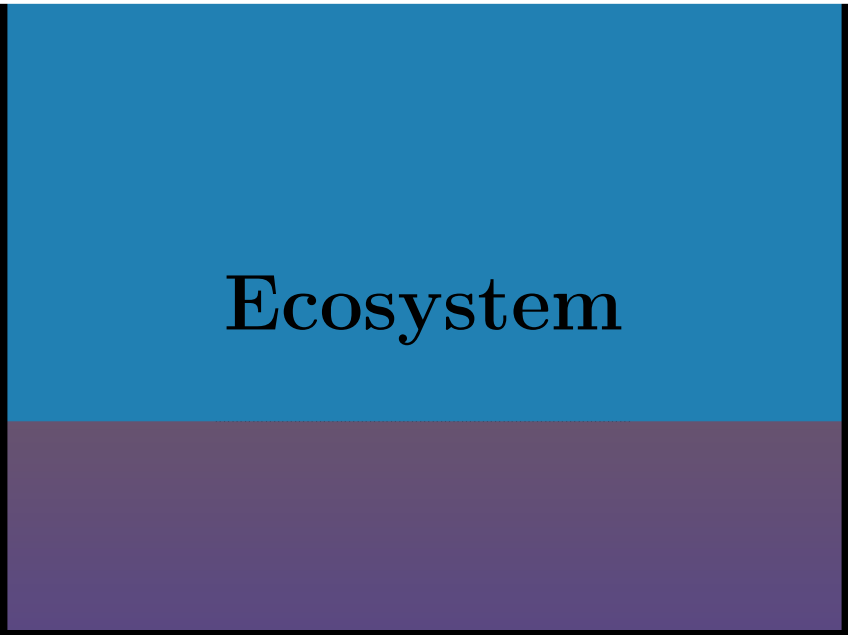
Relative

$$c_r(A,B) = \frac{c_a(A,B)}{c_a(A,A)}$$



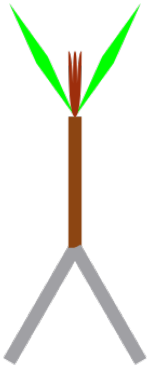
“Worse” Parapatric simulation



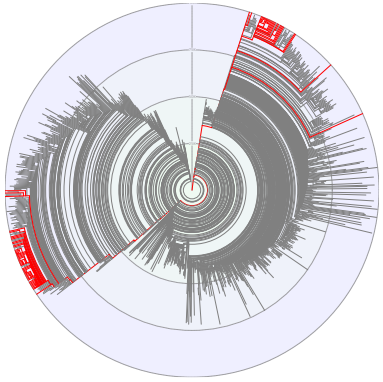


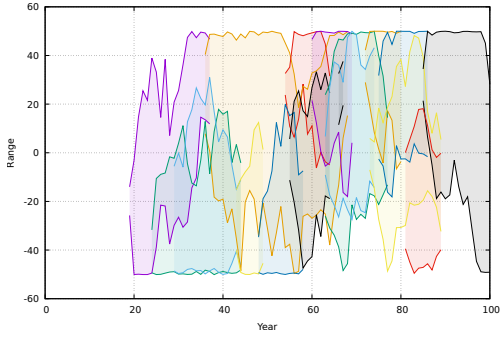
Phylogeny

Simple substrate

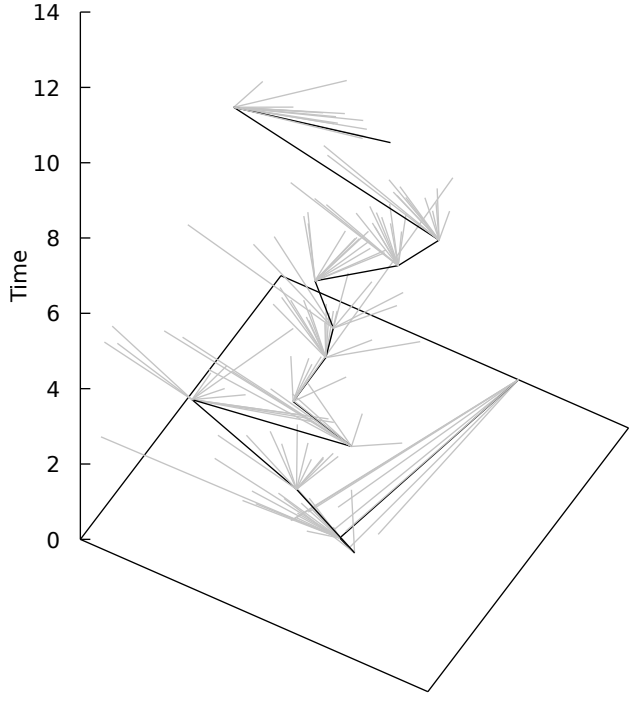


Complex dynamics





Timelines exploration



Source

More on APOGeT at the MethAL workshop
(next parallel session)

Videos

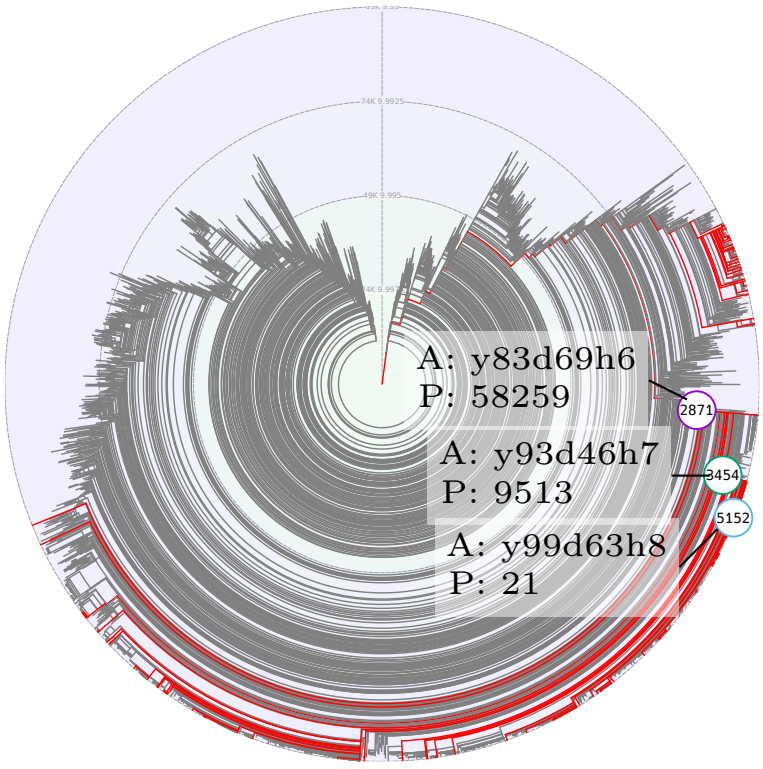
- References
- Inverse speciation
- Other exemples of species dynamics

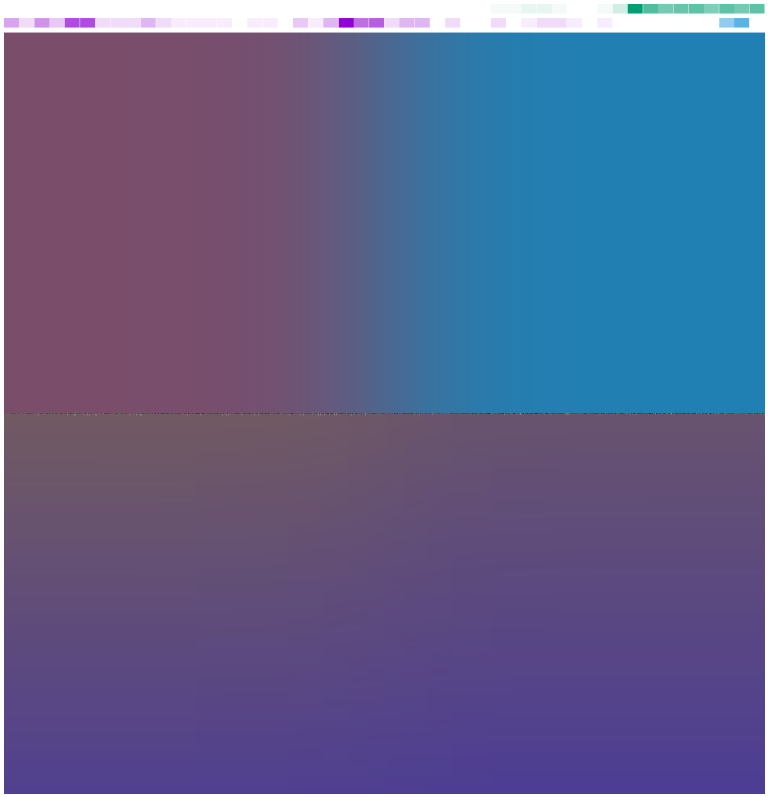

S. Bornhofen, S. Barot, and C. Lattaud. “The evolution of CSR life-history strategies in a plant model with explicit physiology and architecture”. In: *Ecological Modelling* 222.1 (Jan. 2011), pp. 1–10.


Thomas Miconi. “In silicon no one can hear you scream: Evolving fighting creatures”. In: *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*. Vol. 4971 LNCS. 2008, pp. 25–36.


Karl Sims. “Evolving 3D Morphology and Behavior by Competition”. In: *Artificial Life* 1.4 (1994), pp. 353–372.

Inverse speciation





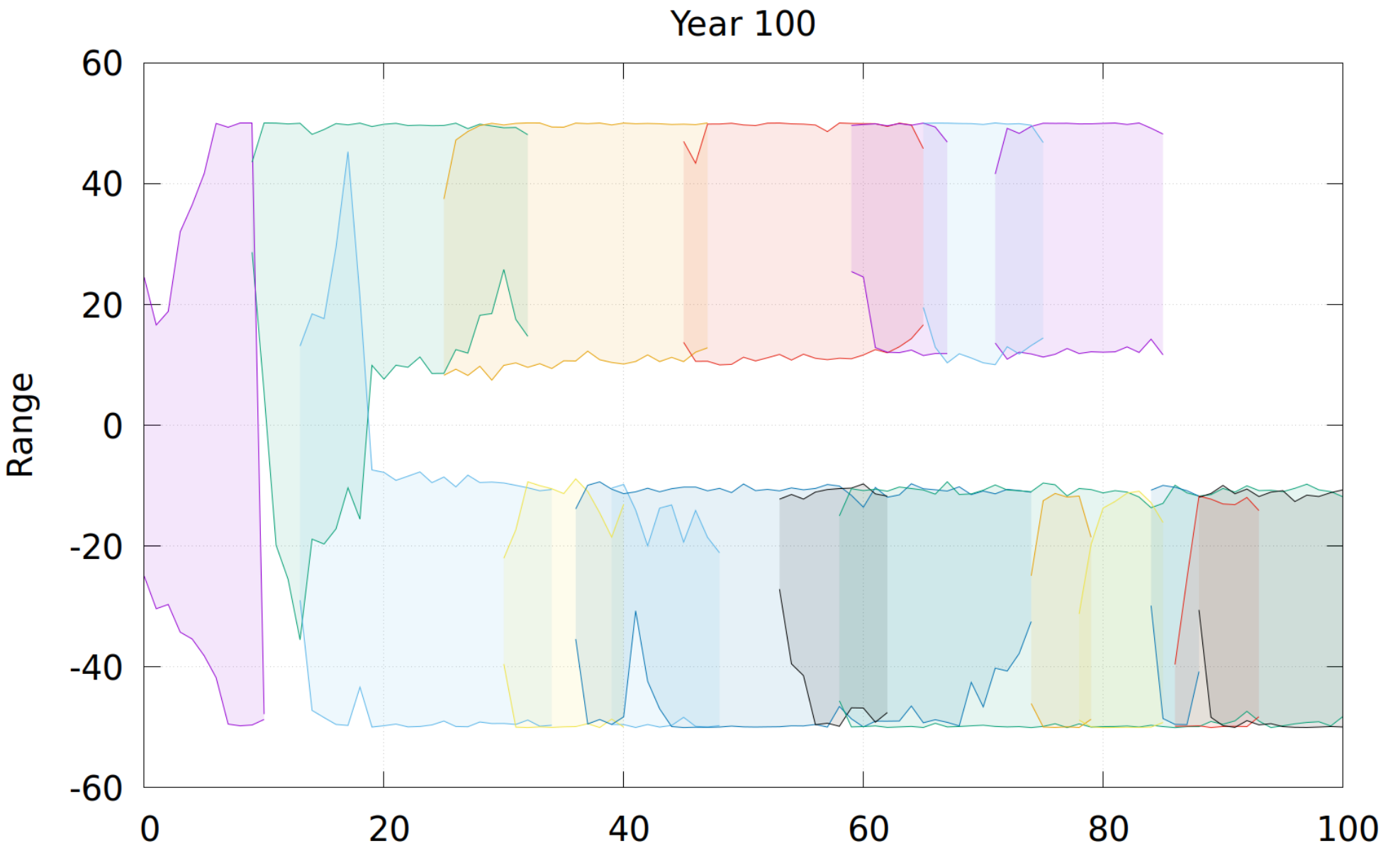
In the case of parapatric_135919_10:

- rc(2871,3454) = 143%
- worse rc(2871,5152) = 217%

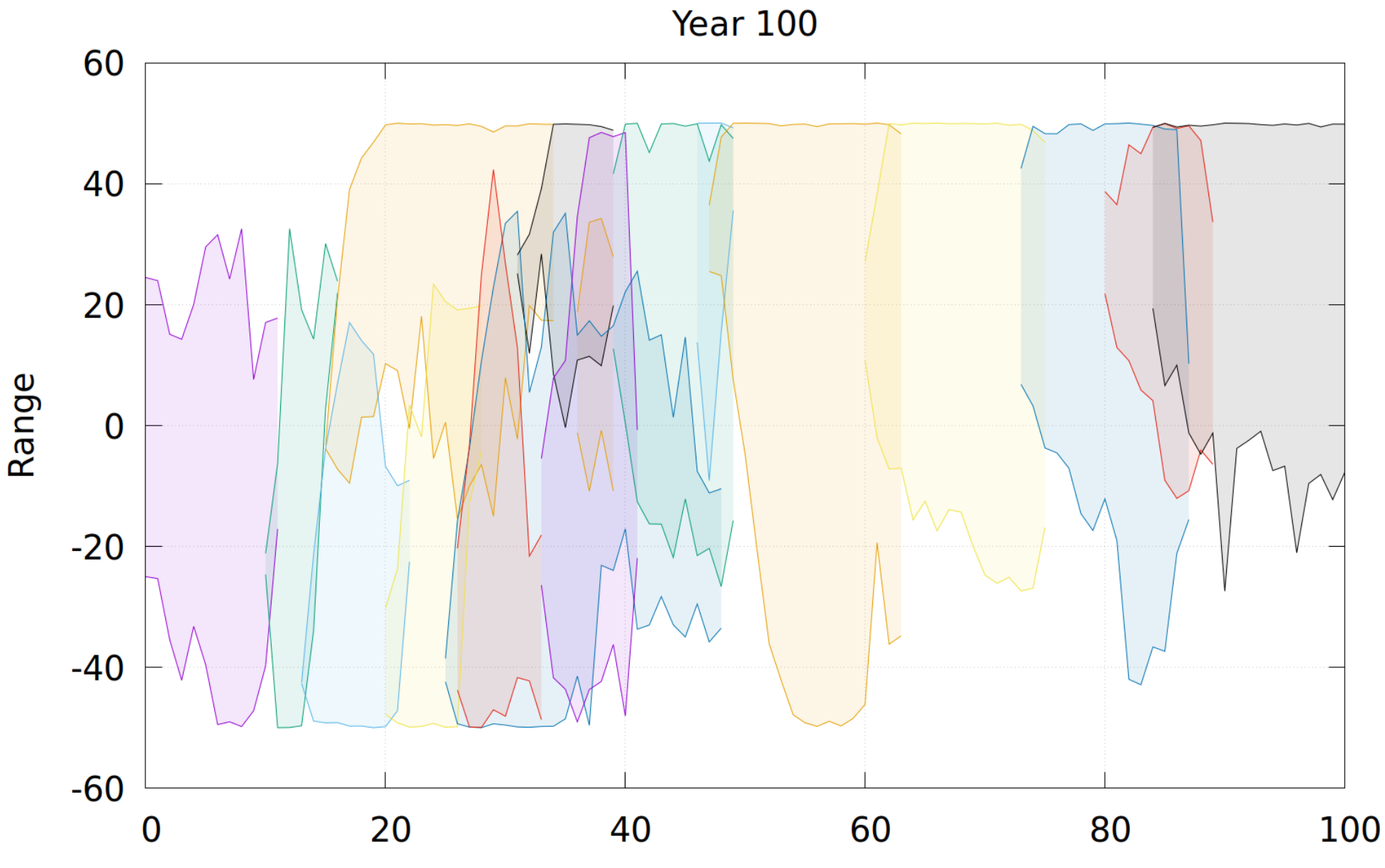
Answer:

- Size of the considered species
- Incomplete cladogenesis

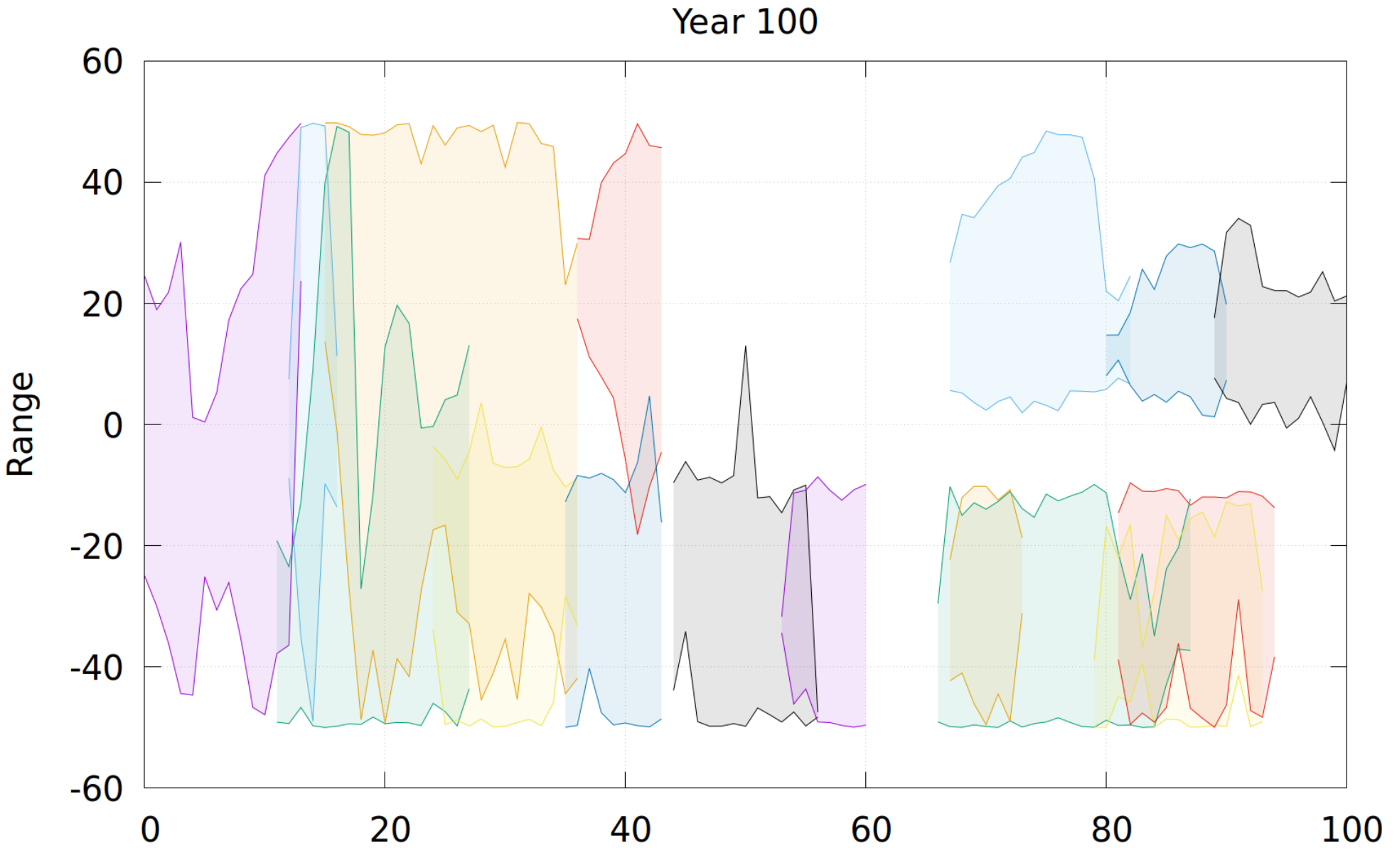
Allopatric simulation



“Best” Parapatric simulation



Peripatric simulation



Peripatric simulation