

DisturPloidy

1 Intro

- Hello everyone...
- For my research I've been concerned with trying to explain...

2 Question

- The prevalence of whole-genome duplication that we see in plants.
- Classic problem of plant biology.
- Polyploid frequency 25% some higher.
- High fitness costs.
- So what is it then, that allows this extreme mutation to spread and become fixed within populations?
- Are there ecological factors that might mediate the relationship between the benefits and costs of being polyploid?
- Environmental disturbance...
- So I approached this problem by creating...

3 IBMs

- This technique is known as...
- IBMs differ to mathematical models.
- They represent every organism in the system explicitly.
- Individual variation.
- Evolution.
- Emergent properties result from interactions.
- IBMs are often targeted to simulate a very specific system in order to make predictions.
- But they can also be targeted more broadly - as I have done - in order to inform Biological theory.

4 Preconceptions

- I didn't really know how IBMs worked...
- Thankfully this is not how modelling works.
- Core processes.
- Removes variables that would be confounding in...
- So we can test the system by...

5 Life-cycle

- I began by considering the individuals.
- This is a life-cycle graph...
- Transitions...
- Core processes (germination/growth etc)
- Defined by parameters/interactions?

6 Costs/Benefits

- Also vital to incorporate costs which...
- And the benefits too, which...
- I don't have enough time to explain them all now...
- But it's important to bring them up because these are...
- I needed to understand them...
- The result of all that is that I now have a model that looks like...

7 Model Flow

- In the circles...
- And in the boxes...
- So that we have a complete system which can be manipulated to...
- So what did I find?

8 Results

- Let me orientate you...
- Base line results where simulations...
- We have time on the X axis...
- Population count on the Y, going up to carrying capacity.
- You can see that the population is stable...
- What I hope you can also see is that from a randomly...
- Now when we add a benefit...
- They differ in strength.
- Next I'm going to show you what happens when we add disturbance.
- Here we have 3 simulations which all have a benefit of being polyploid turned on.
- On the left there is no disturbance, in the middle...
- It's clear to see that landscapes which have been more disturbed...

9 Summary/Questions

- Disturbance really does play a key role in the establishment of polyploids within plant populations.
- I found this out by coding an Individual-based model from scratch in R.
- And I've made that model available as an R package, so...
- Is there anything else you'd like to know?

9.1 Extra slides

1. The individuals
2. The genome
3. The landscape
4. Whole-genome duplication
5. Benefit: Gigas-effects
6. Benefit: Genetic buffering
7. Benefit: Reversal of selfing inhibition
8. Cost: Triploid sterility
9. Cost: Diploid pollen-swamping
10. Disturbance
11. Further Work