DisturPloidy

https://github.com/rosemckeon/ploidy

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IBMs emulate long-term evolutionary studies *in-silico* by simulating biological systems over virtual time.

- They allow for individual variation by representing all individuals in a population *explicitly.*
- This means fewer assumptions.
- Variables we're used to seeing in mathmatical models (like N) become *emergent properties* of the simulation.
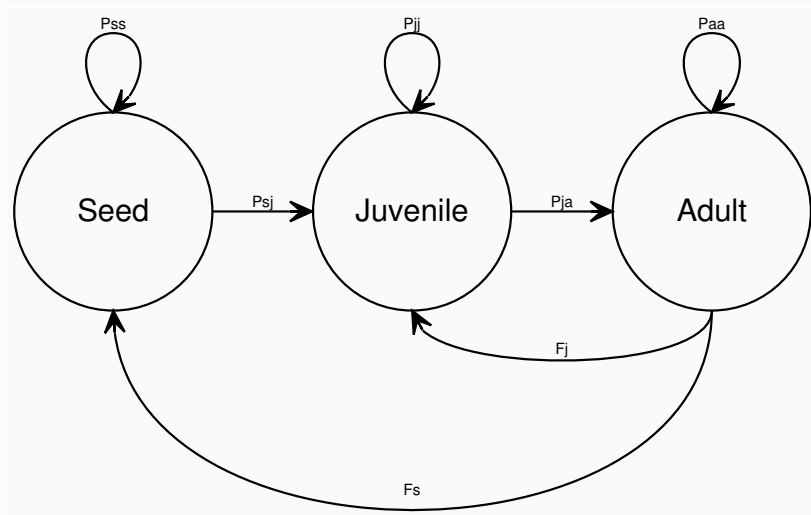- IBMs are tailor made to simulate a specific system.

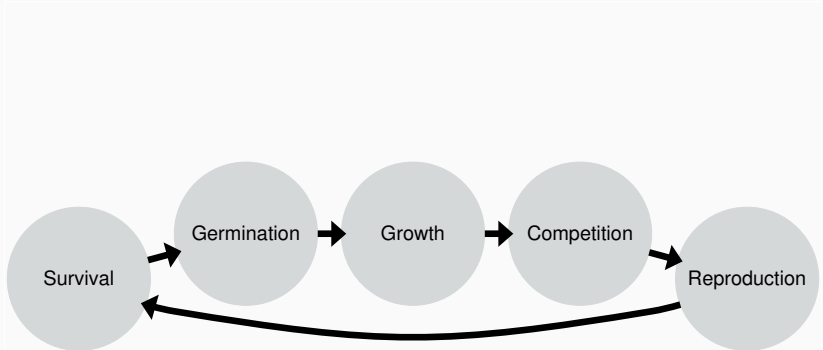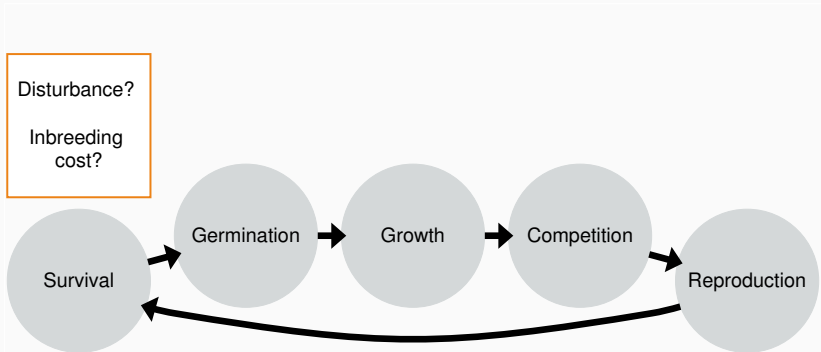**How does disturbance on a landscape affect the establishment of new polyploid plant species?**
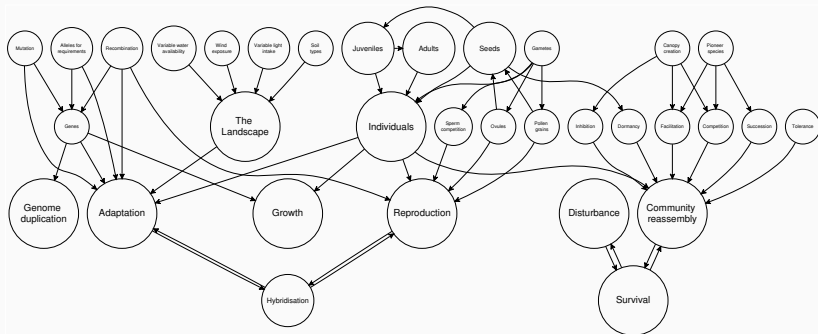
Basically, everything.
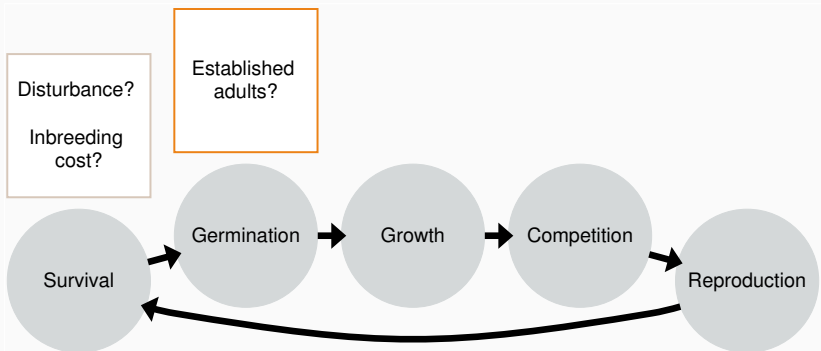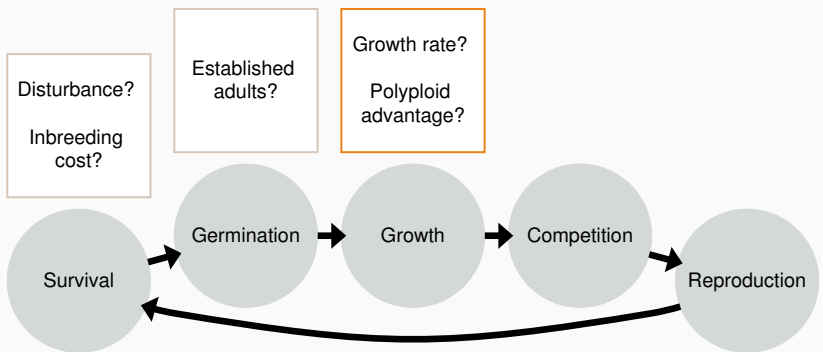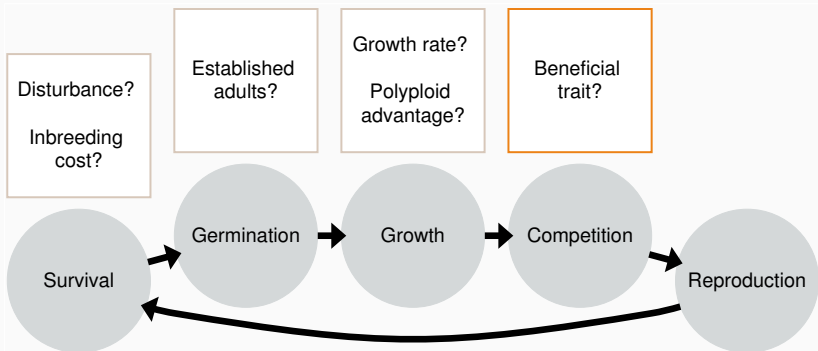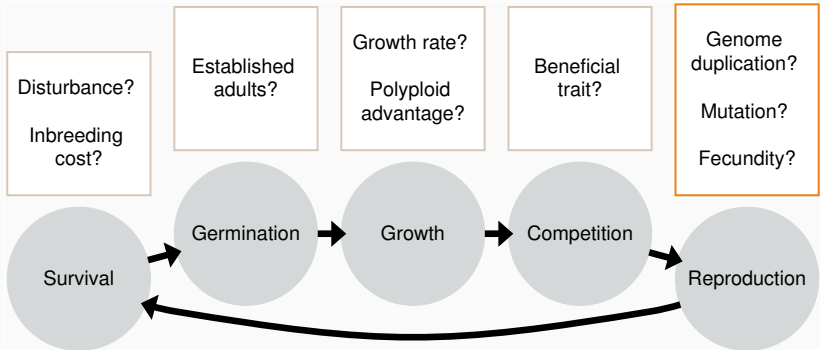
The Individuals

- ID
- X
- Y
- Genome
- Growth Rate
- Inbreeding Value
- Size
- Life Stage
- Ploidy Level

The Individuals

ID	X	Y	life_stage	size	ploidy	gen	growth_rate	inbreeding
0_94	4	5	2	4.219	2	3	1.615935	FALSE
0_23	6	3	2	7.233	2	3	1.933908	FALSE
0_62	7	0	2	3.004	2	3	1.442703	FALSE
0_78	9	1	2	4.299	2	3	1.625779	FALSE
0_23	6	3	2	13.988	2	4	1.933908	FALSE
0_78	9	1	2	6.989	2	4	1.625779	FALSE

allele	locus	value
1	1	48.64990
1	2	60.69052
2	1	89.82384
2	2	83.90019

Costs / Benefits

Costs
Reduce polyploid fitness:

- **Triploid sterility** reduces fecundity.
- **Diploid pollen-swamping** reduces fecundity.

Benefits
Increase polyploid fitness:

- **Gigas-effects** reduce mortality.
- **Genetic buffering** reduces mortality.
- **Reversal of selfing inhibition** increases fecundity.

What did I find out?

Results

Plots here!

I learned even more too.

Further work

Version 2

No due date   **0% complete**

☐	ⓘ **7 Open** ✔ 0 Closed	
☐	ⓘ **Consider including allopolyploids** `enhancement` #104 opened 2 minutes ago by rosemckeon	🖼️
☐	ⓘ **Incorporate delayed maturity of polyploids** `enhancement` #100 opened 4 days ago by rosemckeon	🖼️
☐	ⓘ **Allow polyploids to have increased ovule number** `enhancement` #101 opened 4 days ago by rosemckeon	🖼️
☐	ⓘ **Improve disturbance** `enhancement` #89 opened 14 days ago by rosemckeon	🖼️
☐	ⓘ **Improve cloning** `enhancement` #88 opened 14 days ago by rosemckeon	🖼️
☐	ⓘ **Enable dormancy** `bug` `enhancement` #98 opened 5 days ago by rosemckeon	🖼️
☐	ⓘ **Free up memory** `enhancement` #103 opened 19 hours ago by rosemckeon	🖼️ ⬜ 3

Any questions?

metaphase   **anaphase**
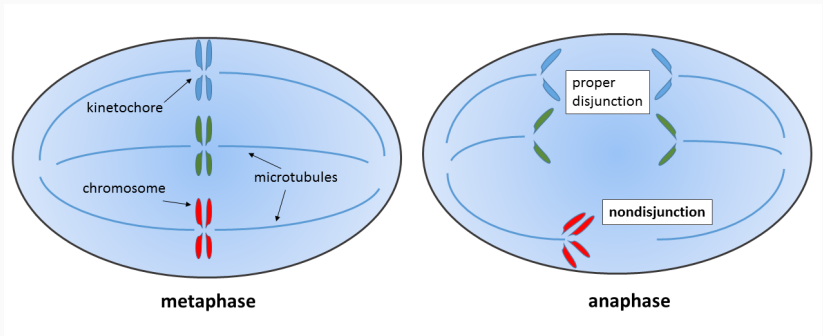
[1]Wpeissner (2014). *Non-disjunction* [image]. Available at:
https://commons.wikimedia.org/w/index.php?curid=32332257

ploidy_growth_benefit

- Can take a value between 0 and 1.
- Any value above 0 allows the contribution of additional alleles for growth rate and so simulates *gigas-effects*.
- Smaller adults have lower fitness.
- Polyploids will have an advantage if ploidy_growth_benefit > 0.

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[1]Tested: 0, 0.5, and 1.

`inbreeding_cost`

- Can take a value between 0 and 1.
- Any value above 0 will increase winter mortality if an individual is homozygous at a specified locus.
- Polyploids will have better survival probabilities than their diploid counterparts, because the chance of being homozygous at any given locus is far smaller.

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[1]Tested: 0, 0.5, and 1.

Benefit: Reversal of selfing inhibition

`selfing_polyploid_prob`

- Takes a value beteen 0 and 1.
- Any value above 0 will give polyploids the ability to self-fertilise.
- This will increase fecundity, especially in the face of limited mate-choice (when `pollen_range` is low).
- Will convey a benefit to being polyploid when set to a value greater than that of diploids (default = 0).

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[1]Tested: 0, and 1 with pollen range reduced from the full landscape to $\frac{2}{3}$ and $\frac{1}{3}$.

Cost: Triploid sterility

`triploid_mum_prob`

- Takes a value between `0` and `1`.
- Any value below `fertilisation_prob` will reduce the fecundity of triploids.
- Triploids in the model make 50/50 haploid/diploid gametes, so including triploid sterility also substantially reduces the chance of new polyploid lines arising.

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[1]Tested: 0, 0.375, and 0.75.

uneven_matching_prob

- Take a value between 0 and 1.
- Acts to affect fertilisation success when gametes possessing different ploidy levels meet (ie: a haploid gamete and a diploid gamete).
- Any value below fertilisation_prob will reduce the fecundity of polyploids, especially when diploid density (an emergent property) is high, and when mate-choice is not limiting (when pollen_range is high).
- This will reduce the appearance of triploids.

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[1]Tested: 0, 0.375, and 0.75.

Disturbance

Disturbance increases mortality over the survival period.

disturbance_freq - Takes a whole number between 0 and max generation. - Any value above 0 enables a chance of disturbance during the winter survival period. - The value represents the likely mean number of generations between disturbances.

disturbance_mortality_prob - Takes a value between 0 and 1. - Any value above 0 increases the chance of mortality during the survival period.

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[1]Tested: 0, 100, 50, 25, and 10.