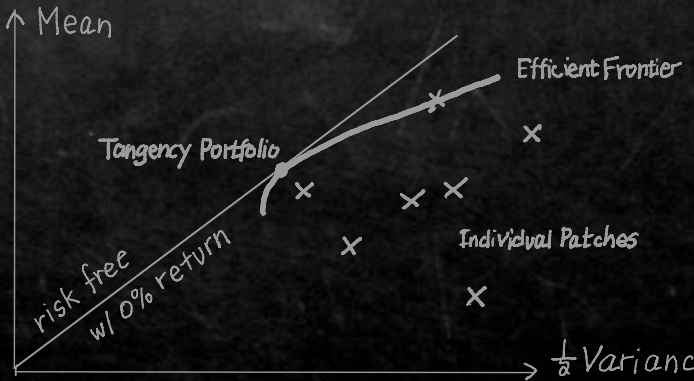
$$dx_i = x_i \sum_{l=1}^{k} p_i^l \left\{ f_i^l (P^l \circ x^l)\, dt + dE_i^l \right\}$$

I. Models & Coexistence

II. Main Results: Coevolutionary Stability

III. Applications: Competing Species Predator-Prey

IV. Modern Portfolio Theory & Finale



Application: Competing Species

$$dx_i = x_i \sum_l p_i^l \left[(r_i^l - p_1^l x_1 - p_2^l x_2)\,dt + \sqrt{v}\, dB_i^l \right]$$

$i = 1, 2$

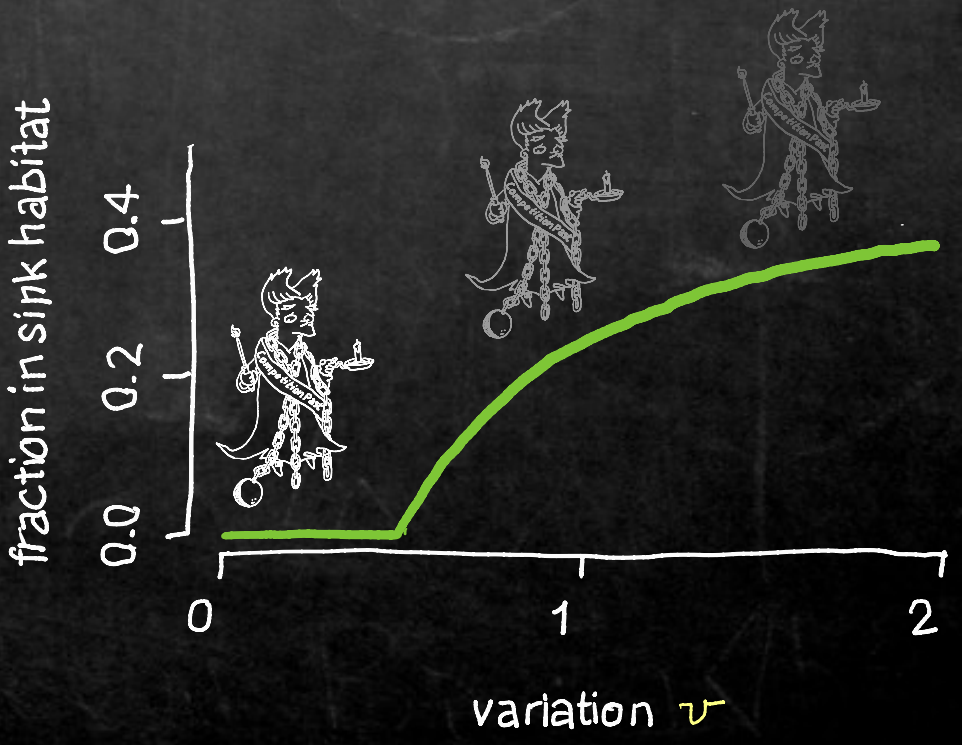
$r_1 - r_2 = \Delta r$ in $K/2$ patches

$r_2 - r_1 = \Delta r$ in $K/2$ patches

spatially uncorrelated environ. fluct. w/ local variance v

$\frac{v}{2} < \frac{\Delta r}{K} \Longrightarrow$ Ghost of comp. past

$\frac{v}{2} > \frac{\Delta r}{K} \Longrightarrow$ Exorcisism (species co-occur)



a numerical approach

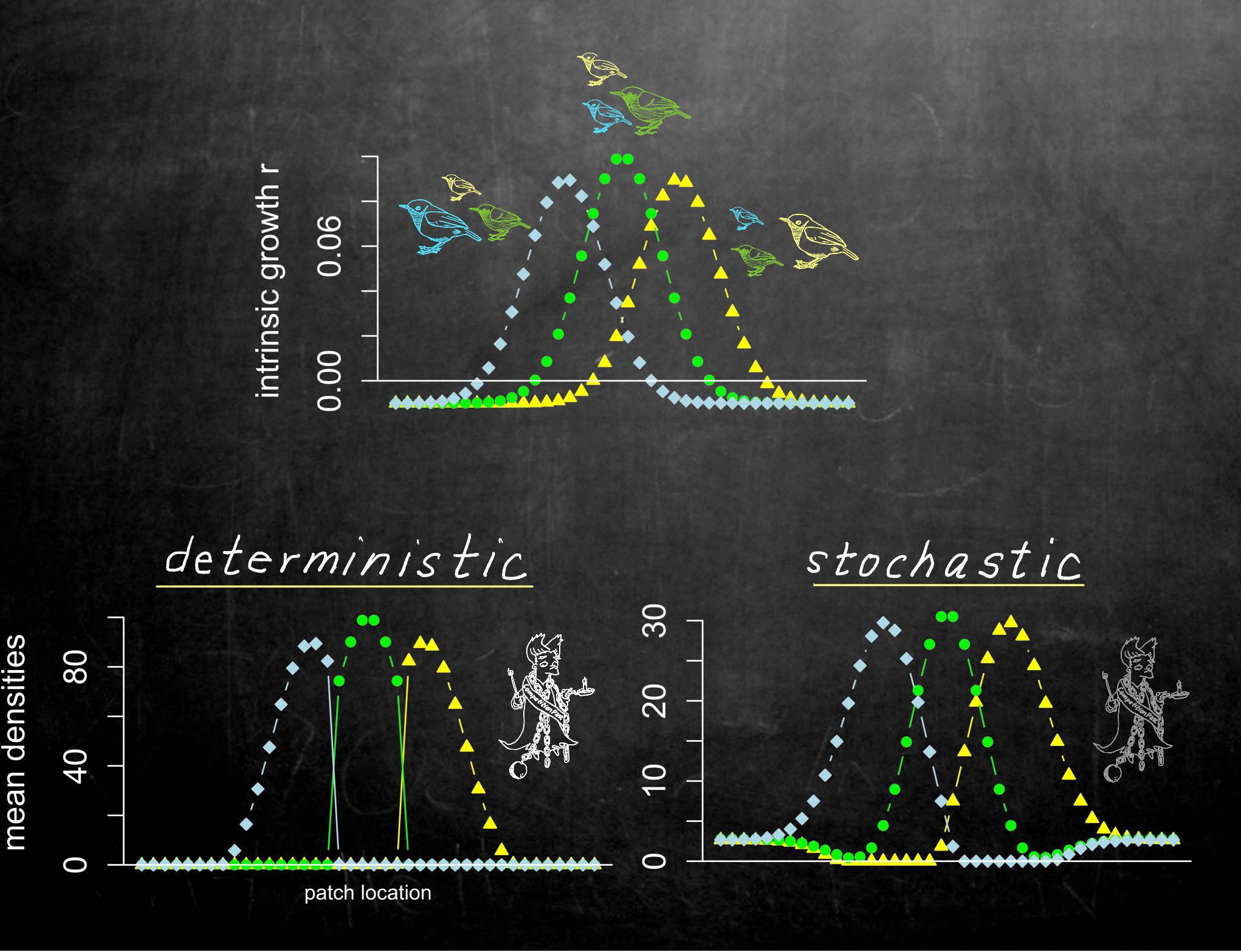
invasion rate

$$\mathcal{L}_i(p,q) = \sum_{l=1}^{k} q^l \, f_i^l(p^l \circ \bar{x}^l) - \frac{1}{2} \sum_{l,m=1}^{k} q^l q^m \sigma_i^{lm}$$

mutation rate μ

$$dp_i^l = \mu p_i^l \left\{ \frac{\partial \mathcal{L}_i}{\partial q^l}(P, P_i) - \sum_m p_i^m \frac{\partial \mathcal{L}_i}{\partial q^m}(P, P_i) \right\} dt$$

equilibria satisfy necessary condition for coESS


intrinsic growth r
0.00
0.06
deterministic
stochastic
mean densities
0
40
80
0
10
20
30
patch location

2
sink

source
1

Application: Predator-Prey

prey

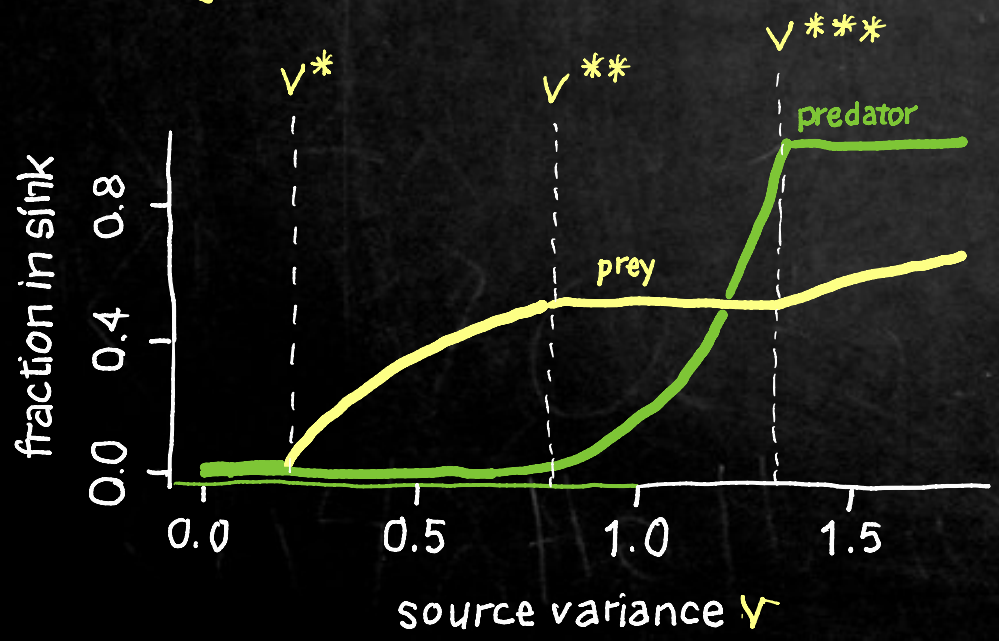
$$dx_1 = x_1 p_1^1 [(r^1 - \varepsilon p_1^1 x_1 - a p_2^1 x_2)\,dt + \sqrt{v}\,dB] + x_1 p_1^2 [-r^2 - a p_2^2 x_2]\,dt$$

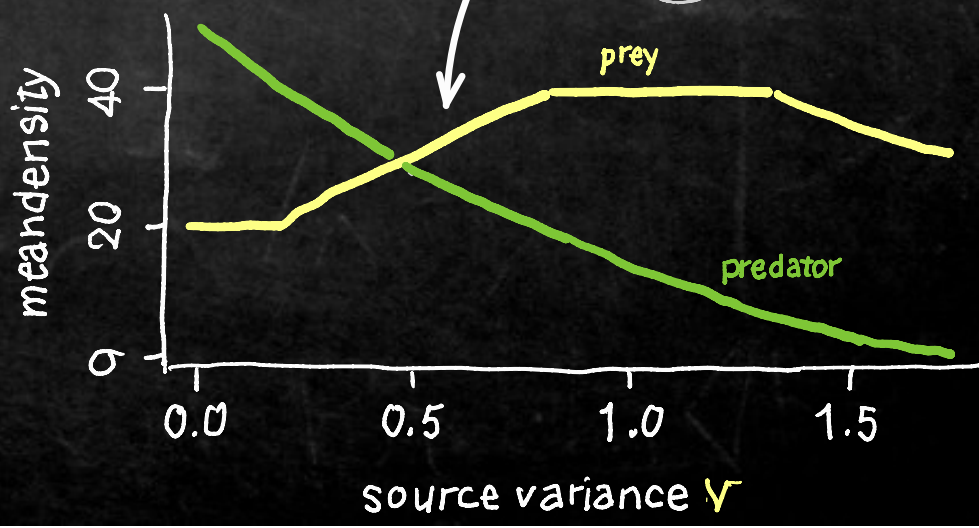
$$dx_2 = x_2 p_2^1 [ca p_1^1 x_1 - d]\,dt + x_2 p_2^2 [ca p_1^2 x_1 - d]\,dt$$

predator

Analytic solns. for coESS

hydra effect



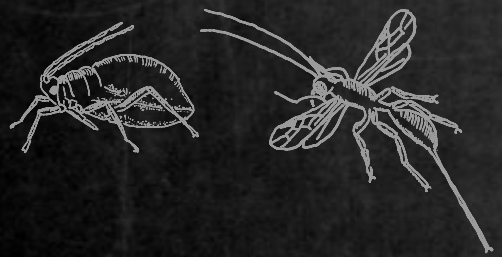


$$dx_i = x_i \sum_{l=1}^{k} p_i^l \left\{ f_i^l (p^l \circ x^l)\, dt + dE_i^l \right\}$$

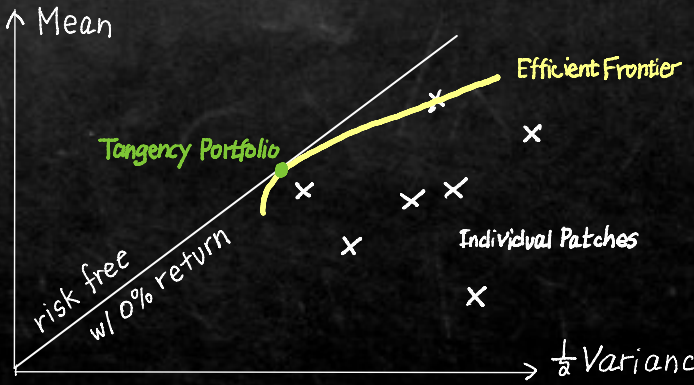
I. Models & Coexistence

II. Main Results: Coevolutionary Stability

III. Applications: Competing Species Predator-Prey



IV. Modern Portfolio Theory & Finale

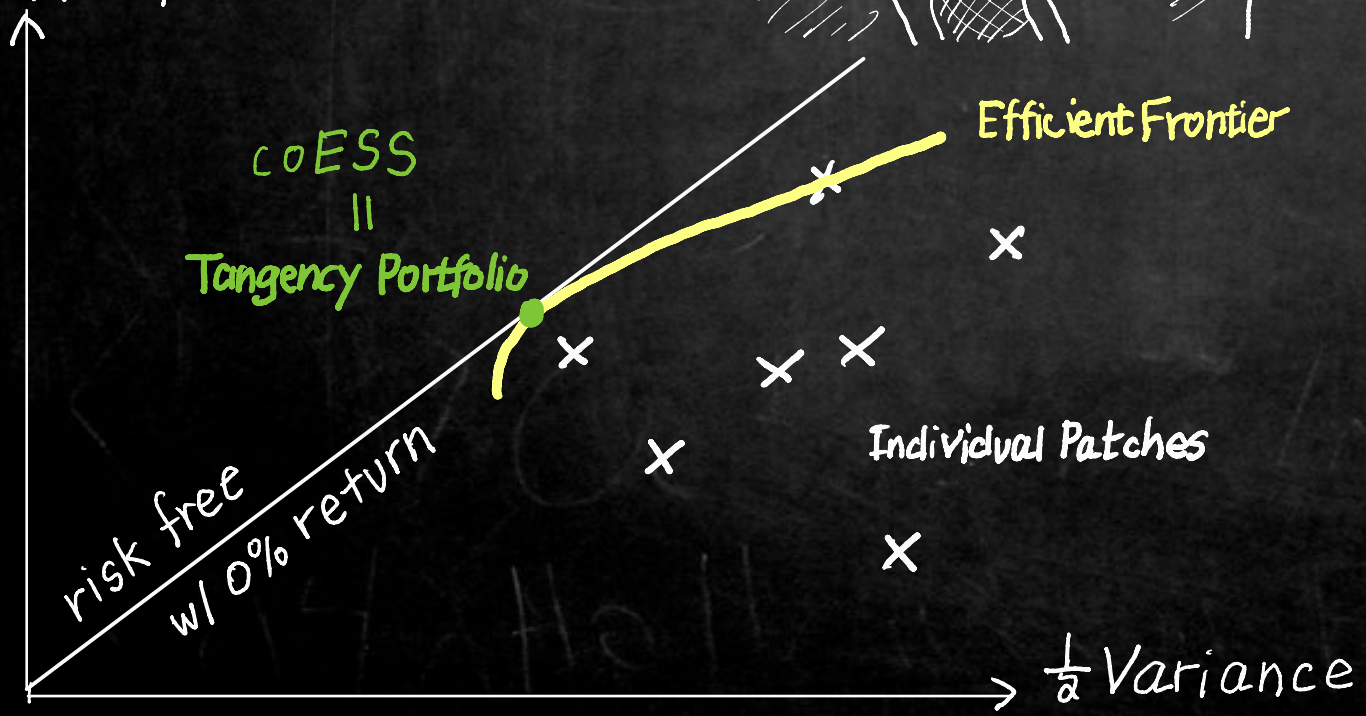


Modern Portfolio Theory: Why It's Still Hip

By BEN MCCLURE | Updated Jan 16, 2020

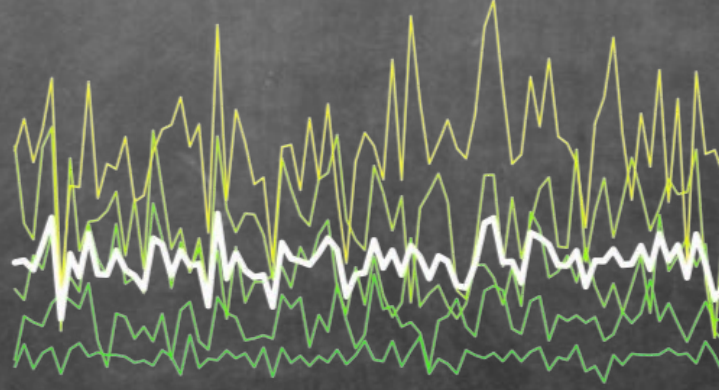
A good portfolio is more than a long list of good stocks and bonds. It is a balanced whole, providing the investor with protections and opportunities with respect to a wide range of contingencies.

— Harry Markowitz —



FINALE

This KISS framework extends prior work on evolution of patch selection to metacommunities experiencing spatio-temp. variation



$f_i^l - cov_i^l$ equal in all occupied patches and lower elsewhere

temporal var. + species interactions can select for sink populations, exorcise ghost of comp. past, and select for Hydra effects.


THANK YOU
FOR LISTENING
& NSF FOR FUNDING
QUESTIONS?
INSTITUT HENRI POINCARE