Figures for my Systems class, making talk slides, etc.

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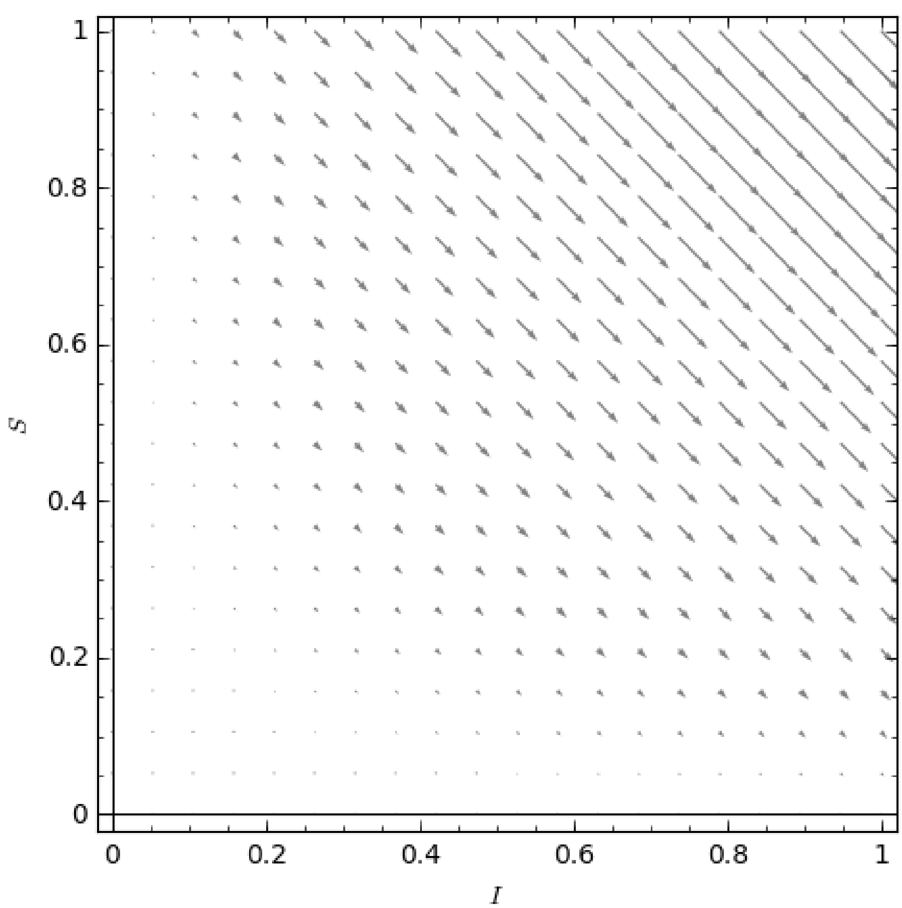

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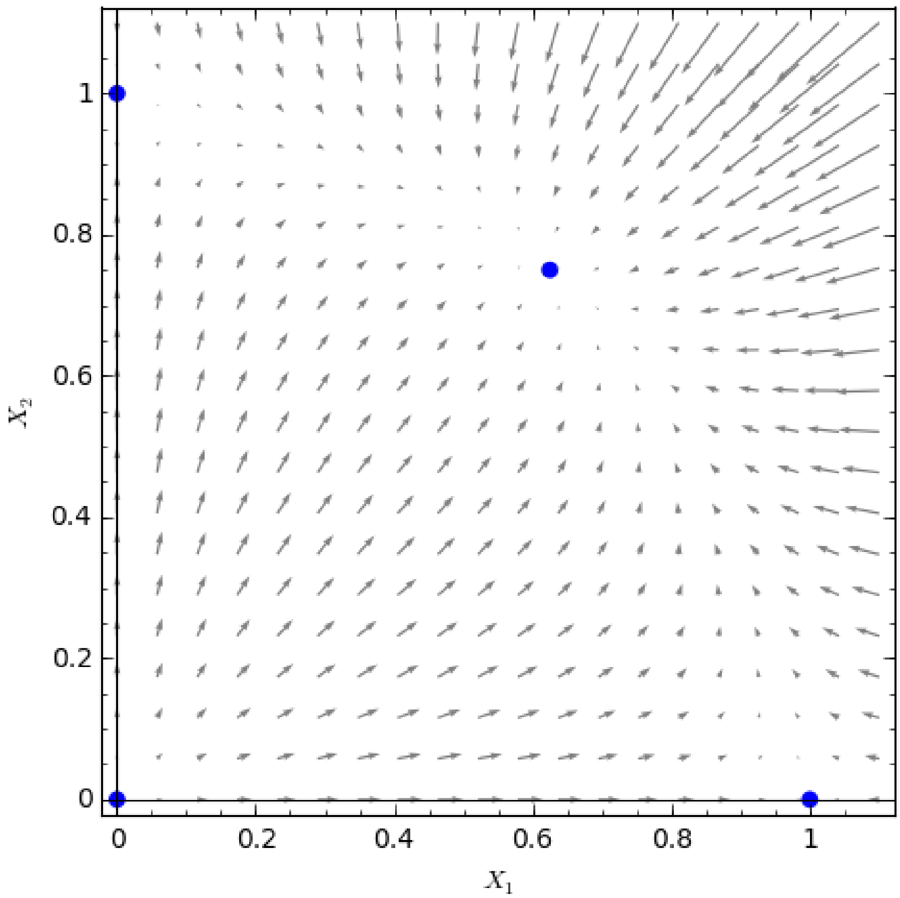
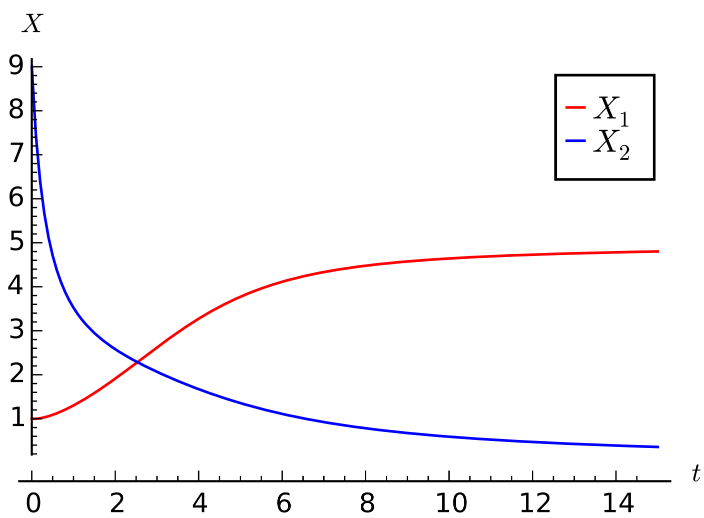


Adap. Dyn. eqns for talk slides

$$\frac{dX_1}{dt} = -\frac{1}{5}\,X_1^2 - \frac{1}{10}\,X_1X_2 + X_1$$
$$\frac{dX_2}{dt} = -\frac{1}{5}\,X_1X_2 - \frac{1}{3}\,X_2^2 + X_2$$



Given ecological dynamics

$\frac{dX_i}{dt} = \cdots$

And distribution of variation

p_i

We can infer the adaptive dynamics:

$\frac{dp_i}{dt} = \gamma \hat{X}_i \frac{\partial}{p_i} S(p_i)$

The adaptive change in the "ecological characteristics" $\mathbf{e}_i$

$\frac{d\mathbf{e}_i}{dt} = \gamma \hat{X}_i \bar{\mathbf{S}}(\mathbf{e}_i)$

is not in the "ideal" direction

$\mathbf{S}(\mathbf{e}_i)$

but in the ideal direction constrained by the available variation in $\mathbf{p}_i$:

$\bar{\mathbf{S}}(\mathbf{e}_i) = \frac{\partial \mathbf{e}_i}{\partial \mathbf{p}_i} \frac{\partial \mathbf{e}_i}{\partial \mathbf{p}_i}^T \mathbf{S}(\mathbf{e}_i)$

Lotka-Volterra population

dynamics:

$\frac{dX_i}{dt} = r_i X_i + \sum_j a_{ij} X_i X_j$

"Interaction term" a_{ij} describes the effect of population j on population i.

a_{ij}

a_{ji}

a_{i1}

a_{i2}

Population i's adaptation depends on the r_i and a_{ij} terms that affect it.

$\mathbf{S}(a_{ij}) = \frac{\partial}{\partial a_{ij}}(r_i + \sum_j a_{ij} X_j^*)$

$= X_j^*$

The "ideal direction" of change in these interactions is always positive.

sage.mk

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