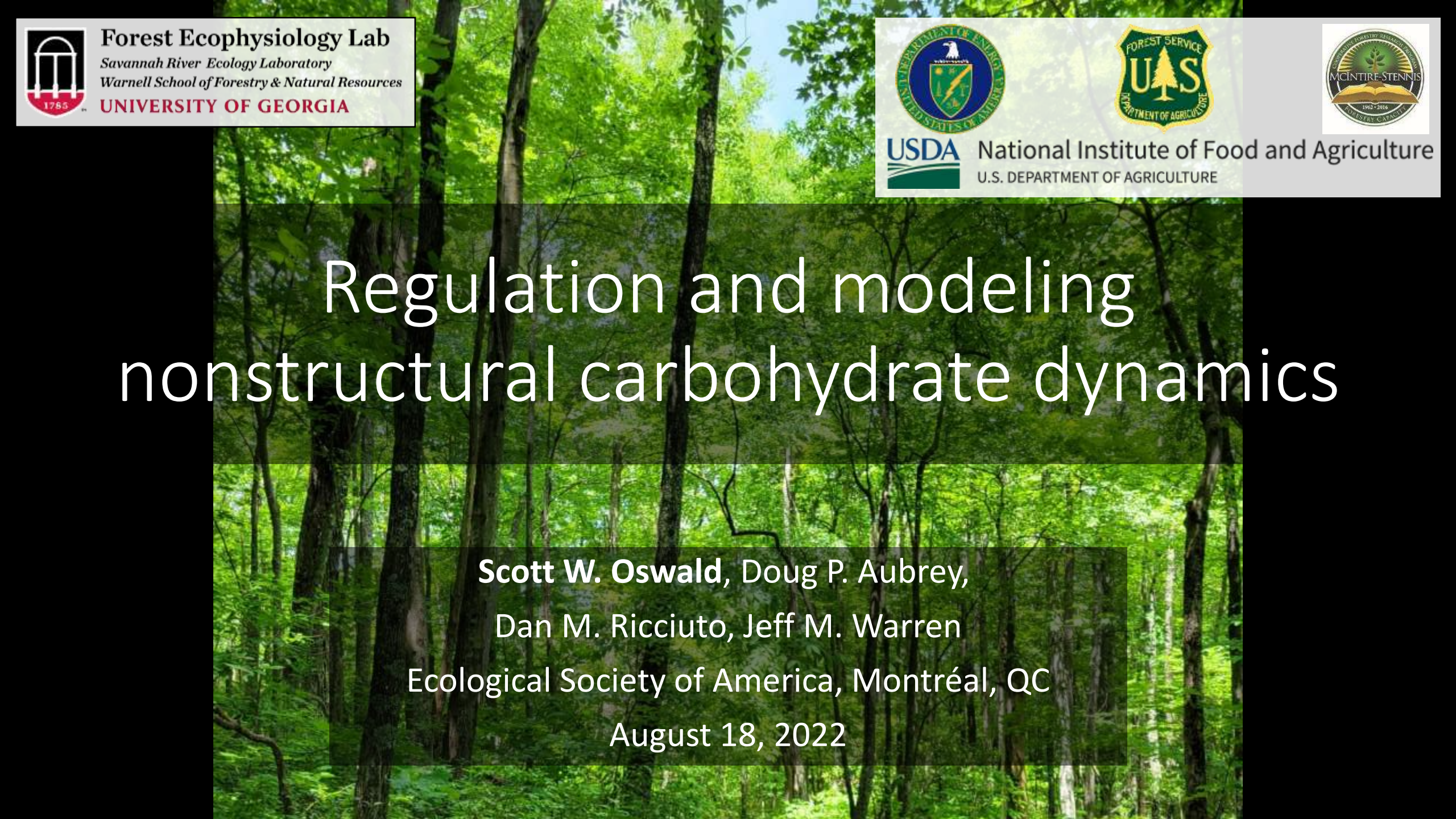

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Regulation and modeling nonstructural carbohydrate dynamics

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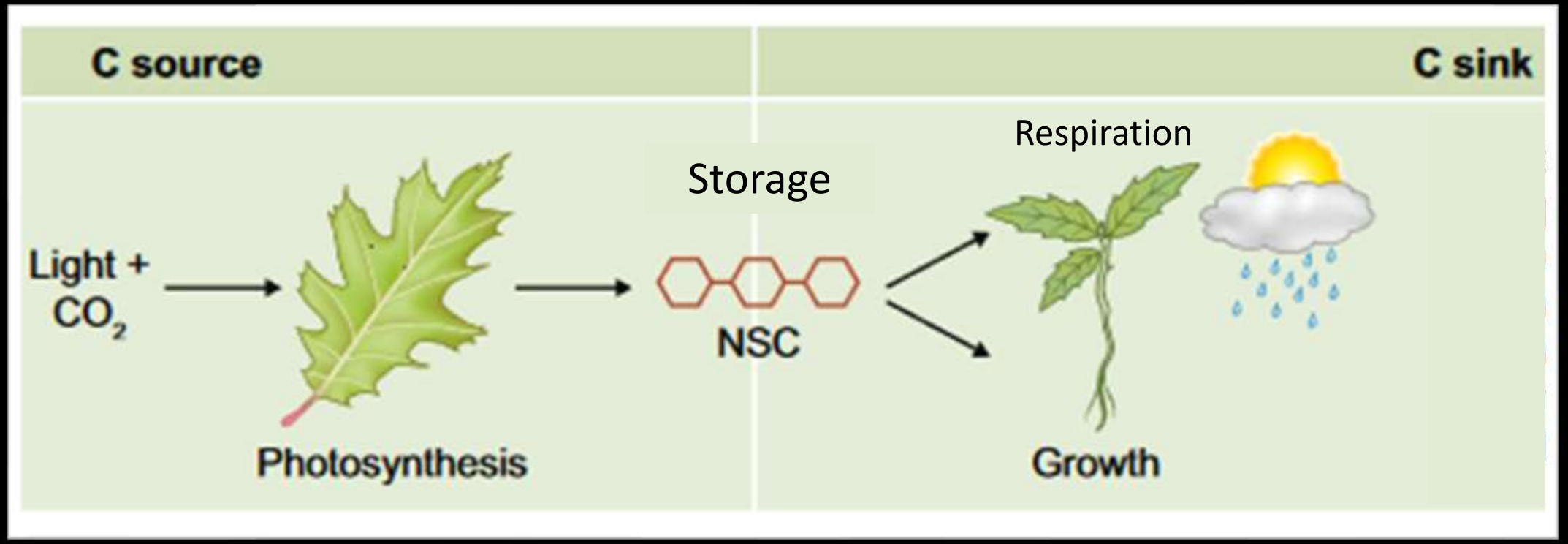
Ecological Society of America, Montréal, QC
August 18, 2022

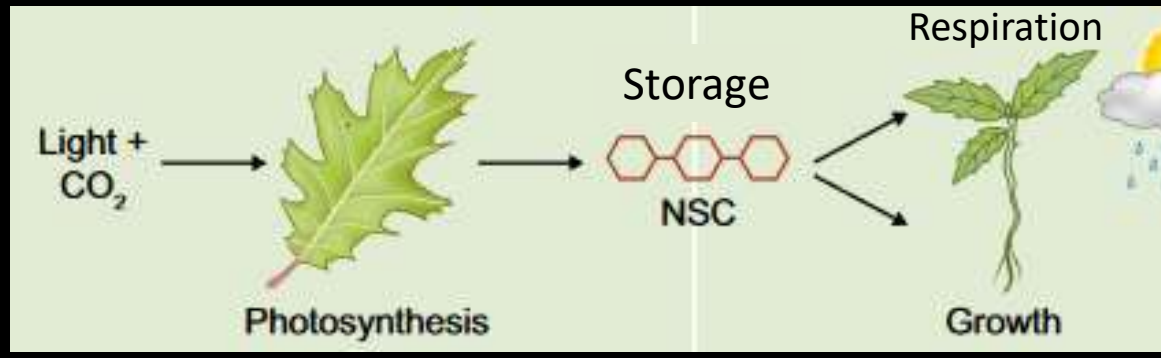
Fig 1. Fatichi et al. 2019

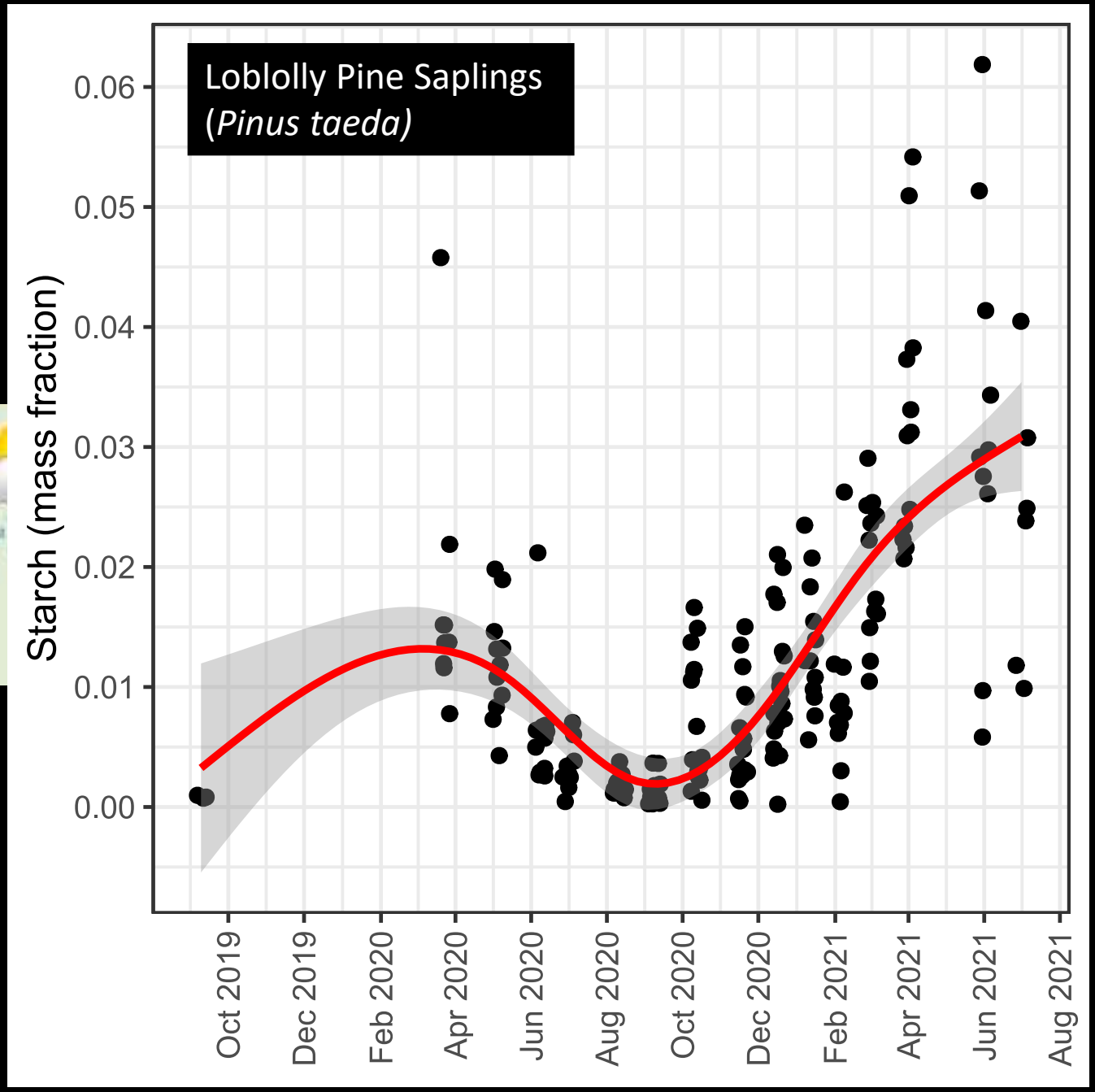


Nonstructural carbohydrates = NSC = sugars + starch

From here to there…

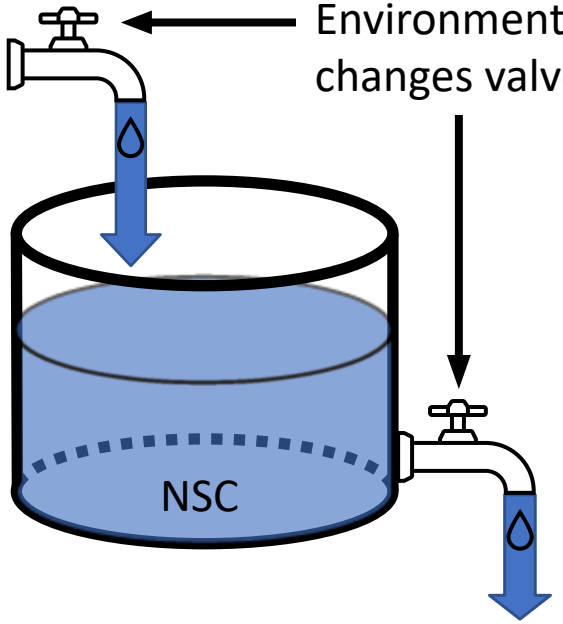
- From processes to dynamics





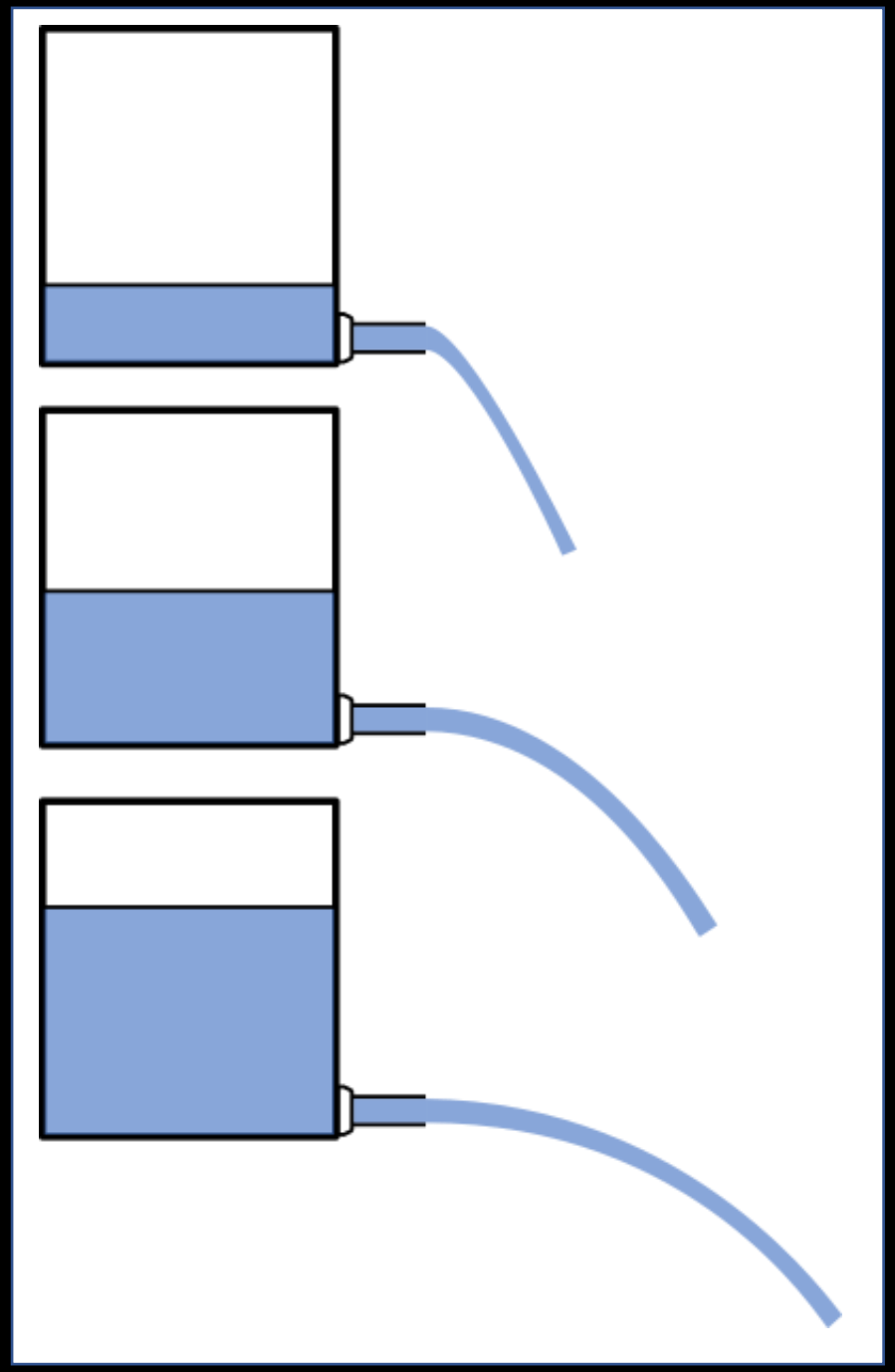
Carbon mass balance analogy

Photosynthesis = NSC supply

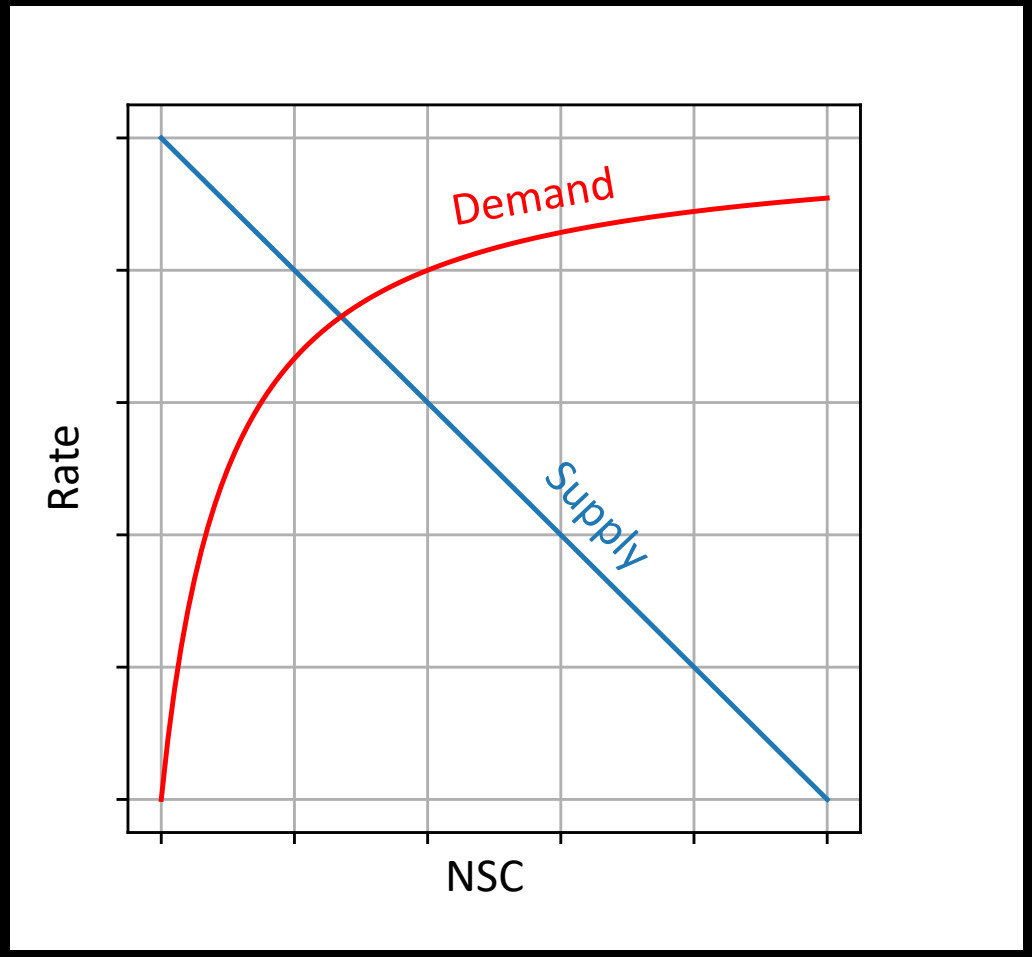


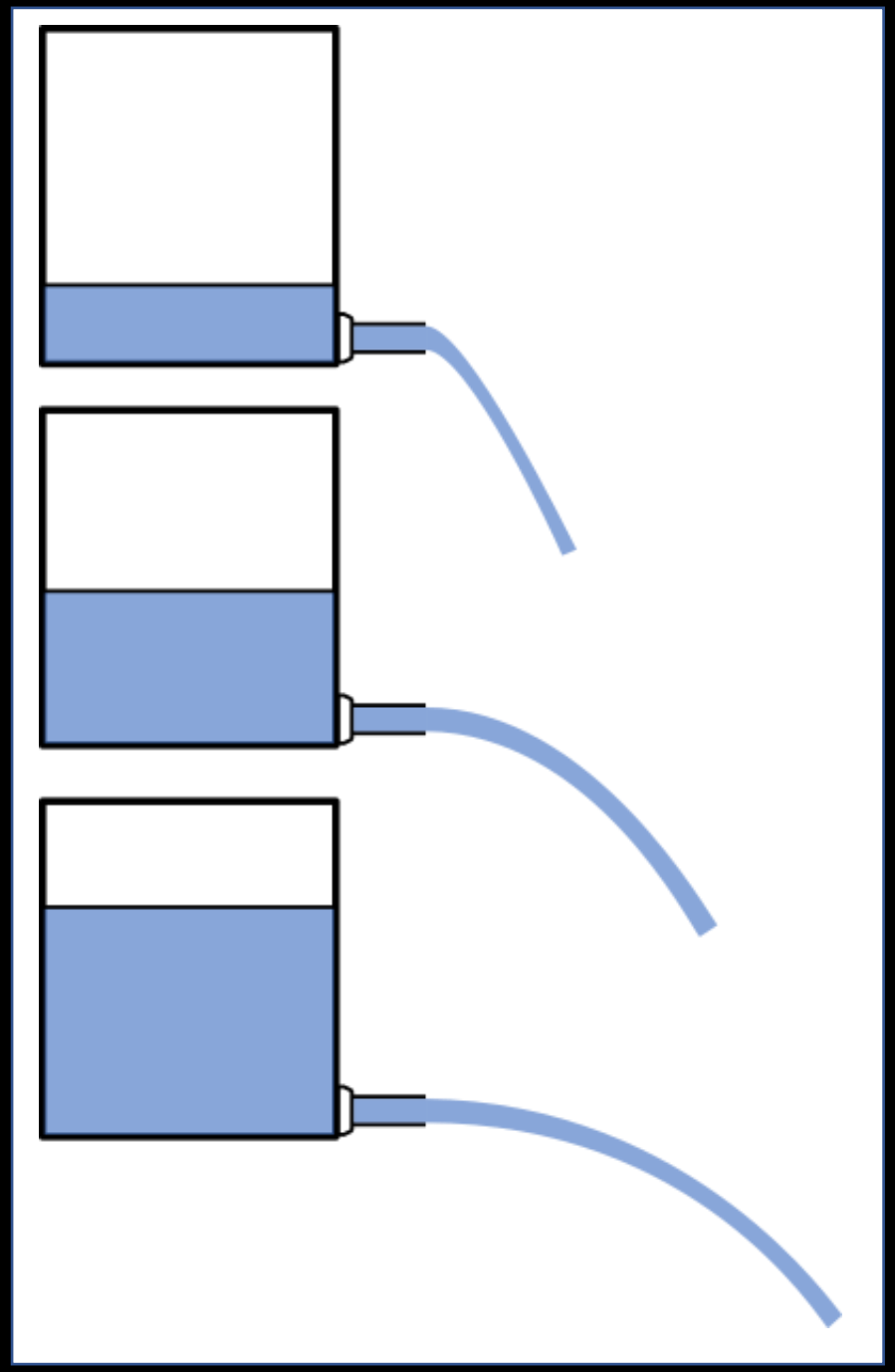
Respiration + Growth = NSC Demand

$$\frac{d}{dt}[\mathrm{NSC}] = \mathrm{supply} - \mathrm{demand}$$

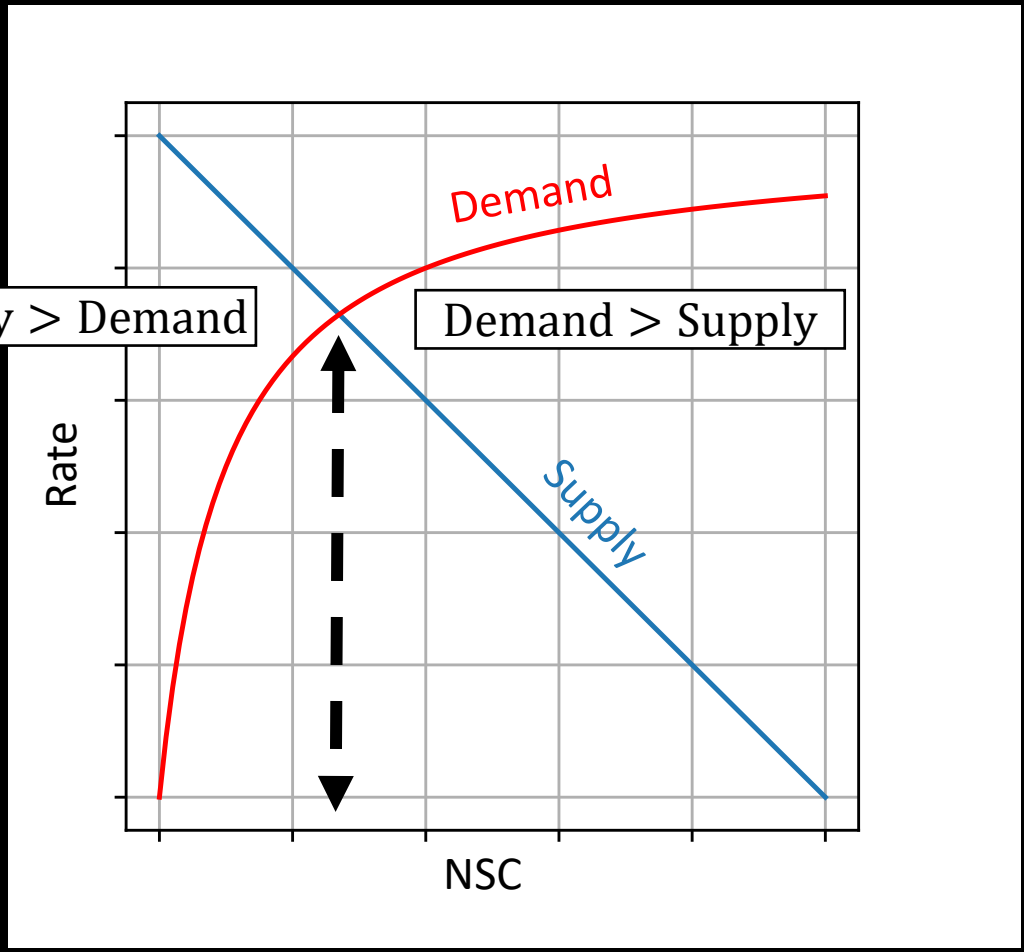


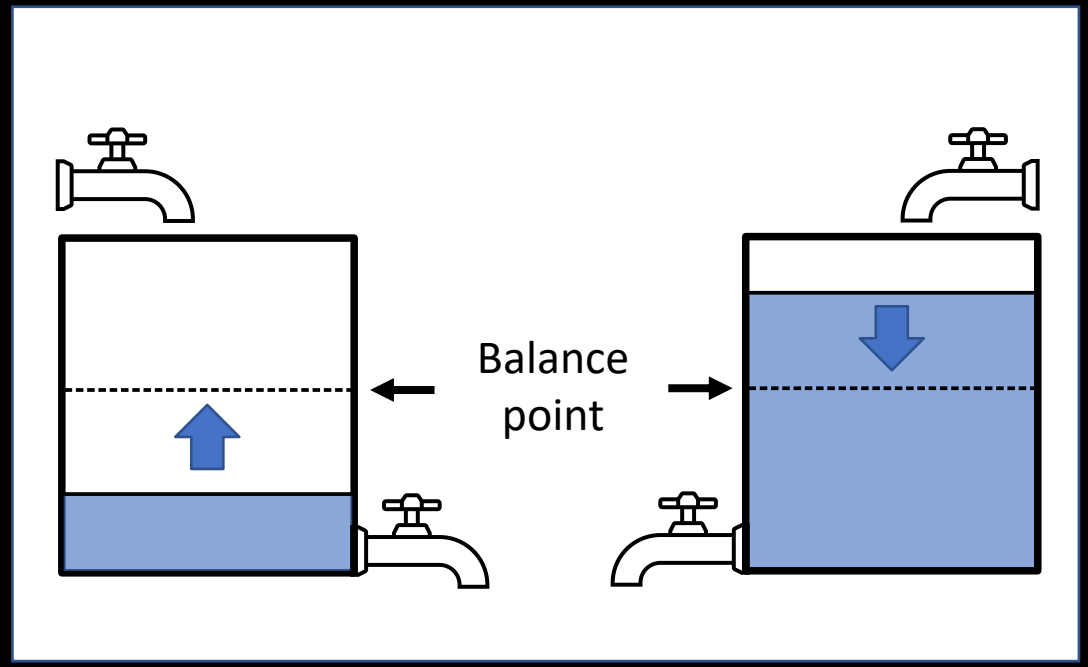
Supply and demand feedback = how inflow and outflow depends on NSC

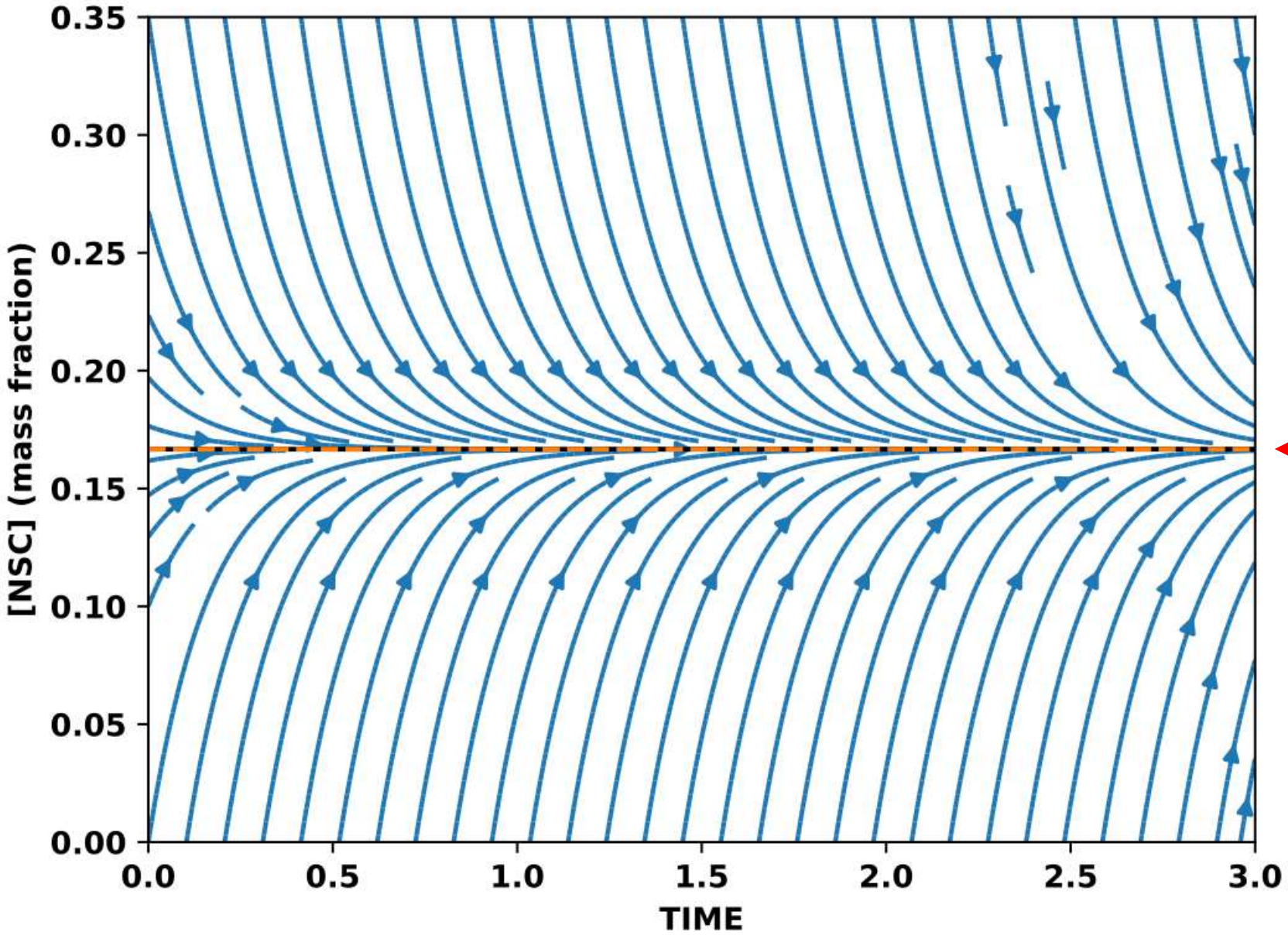




In constant environment
NSC supply and demand
feedback determines response + dynamics



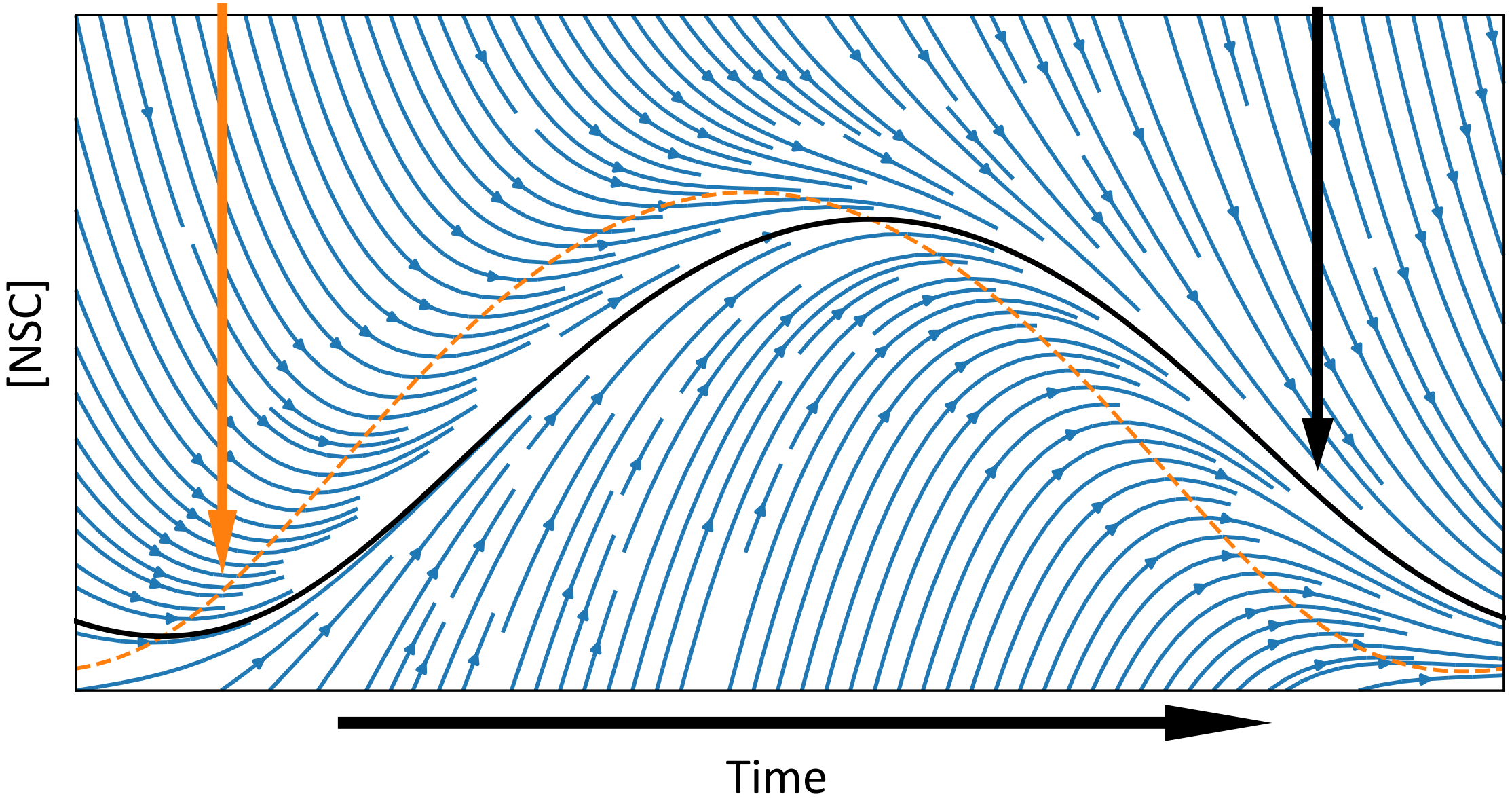




Balance point
=
Long-term NSC response
=
Attractor

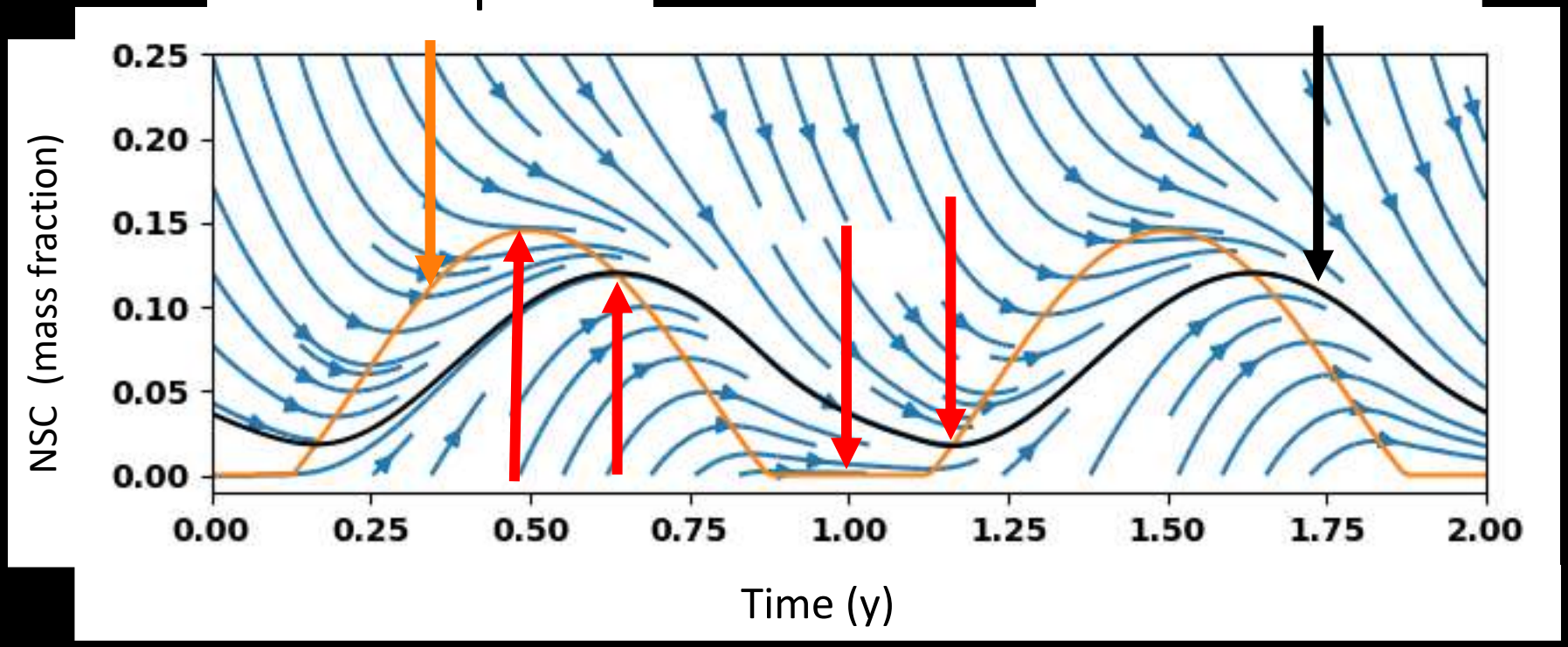
Changing environment changes
Balance point

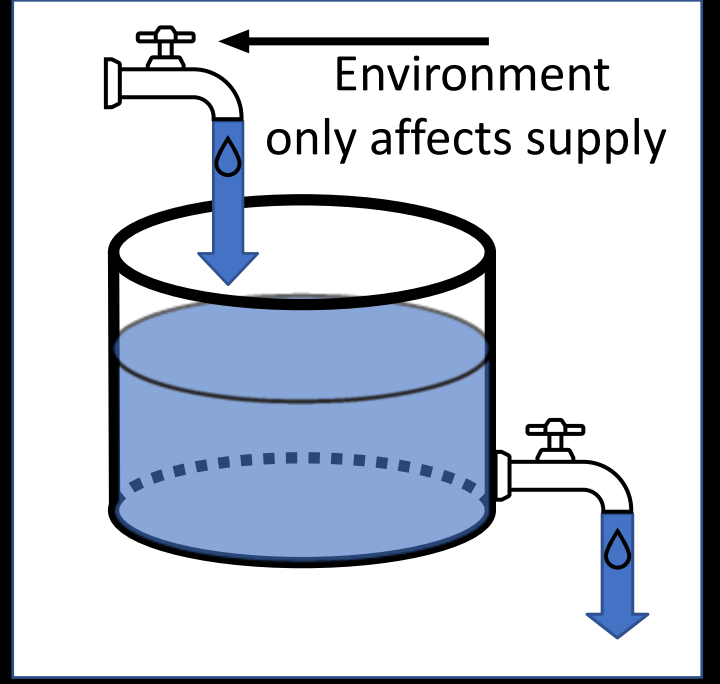
Long-term NSC response =
Attractor

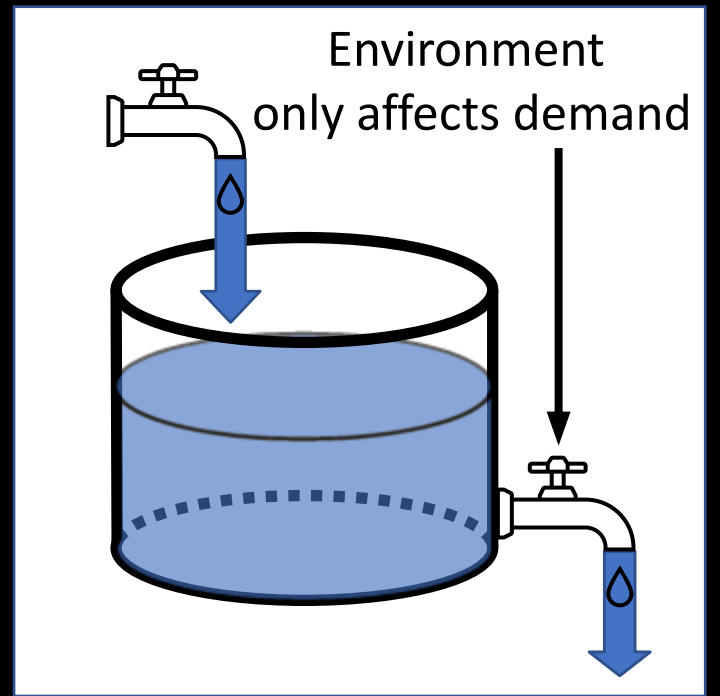


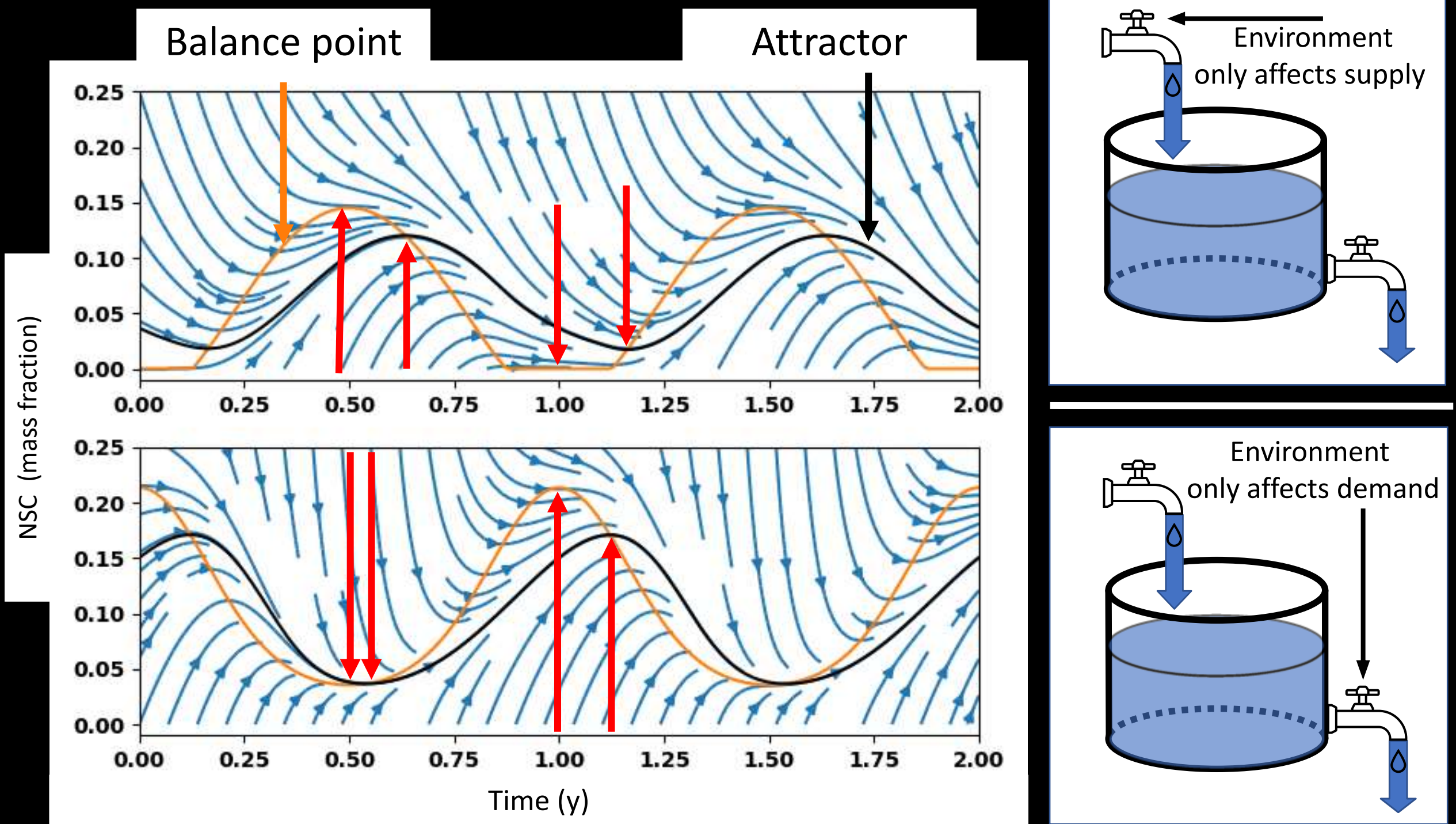
Balance point

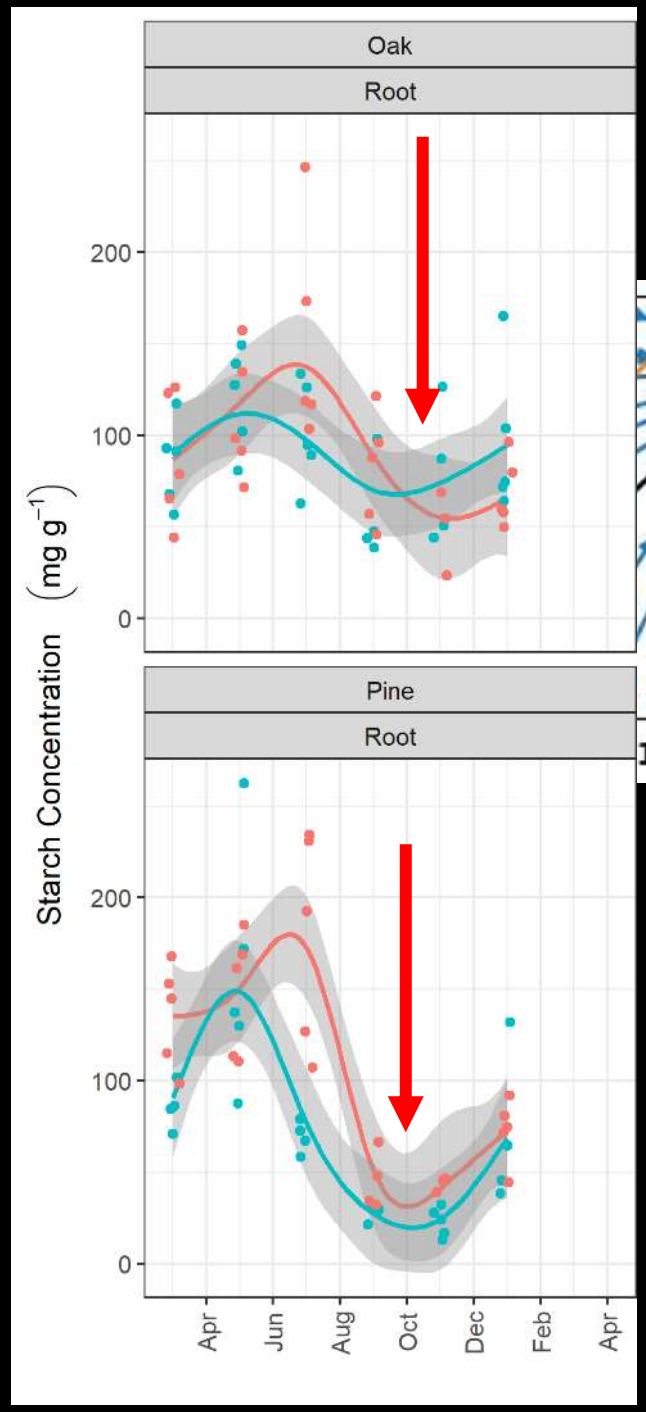
Attractor



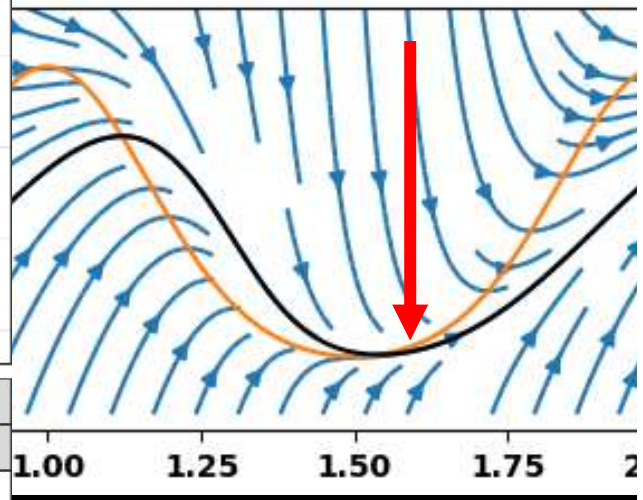




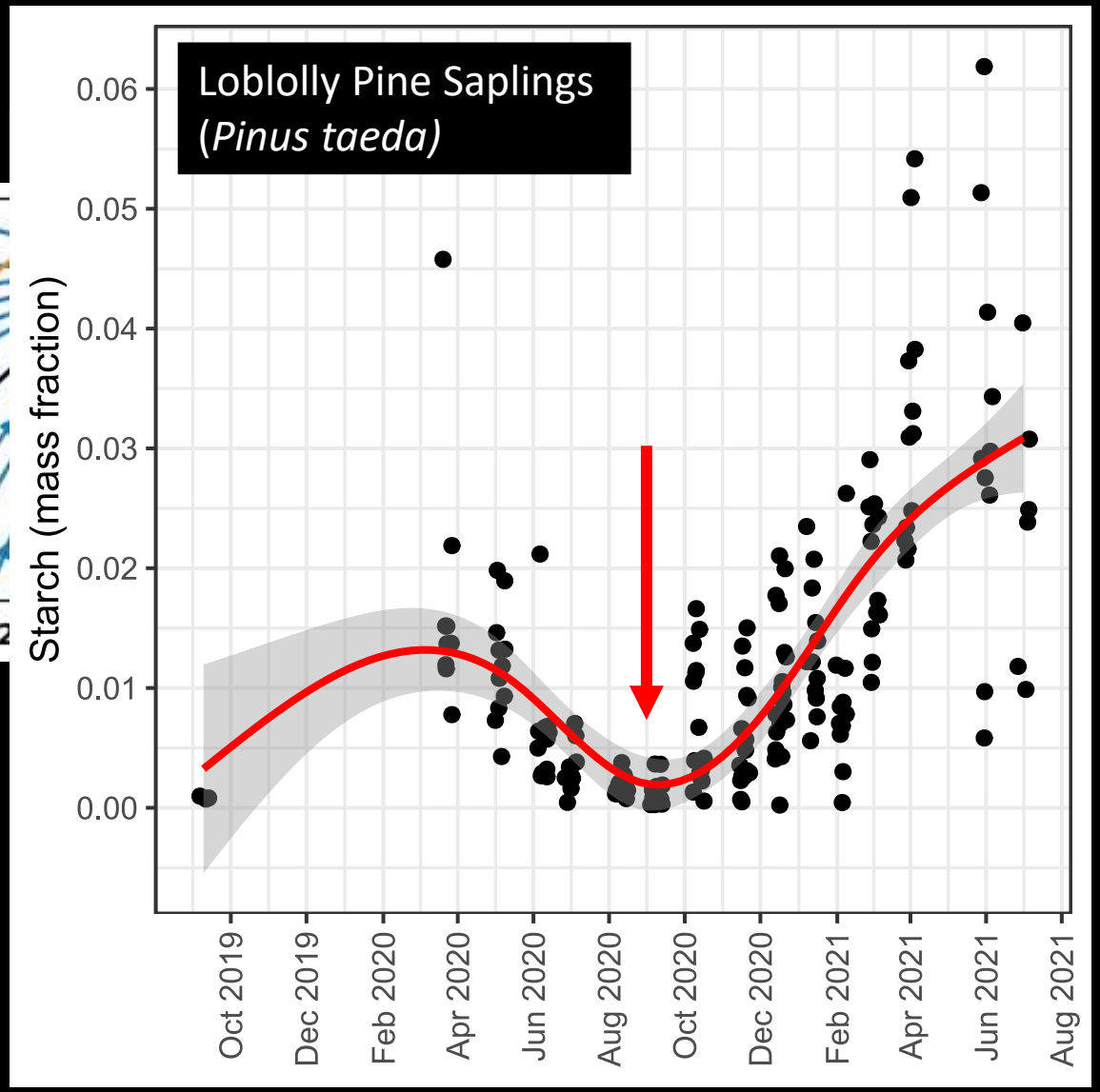

Balance point
Attractor
NSC (mass fraction)
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Time (y)
Environment
only affects supply
Environment
only affects demand



Mature Turkey Oak
(*Quercus laevis*)

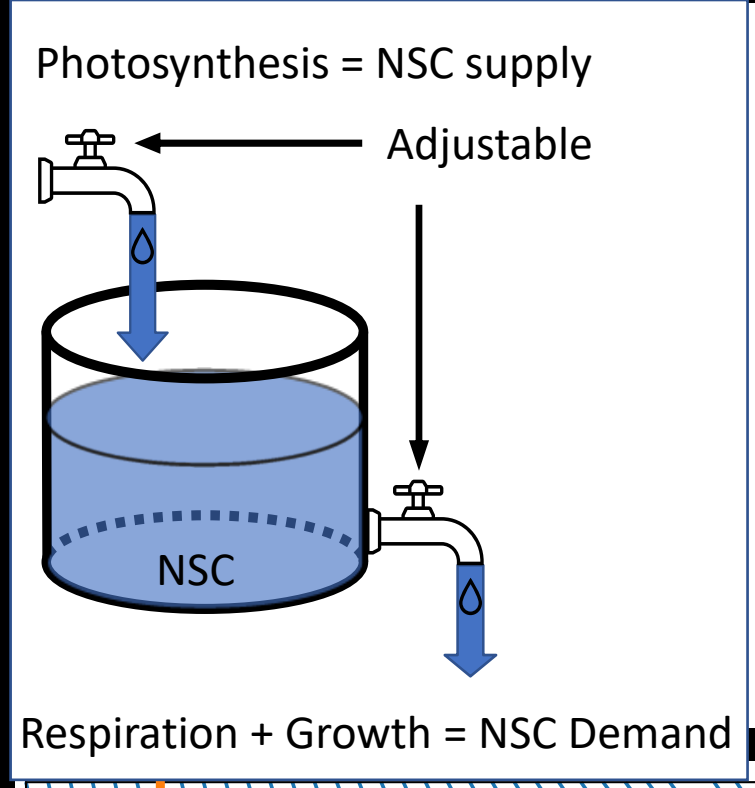


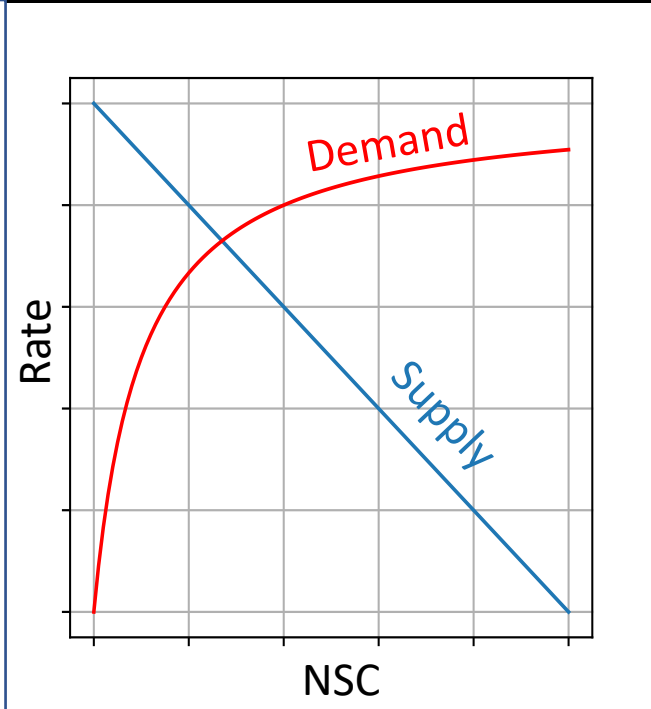
Mature Longleaf Pine
(*Pinus palustris*)

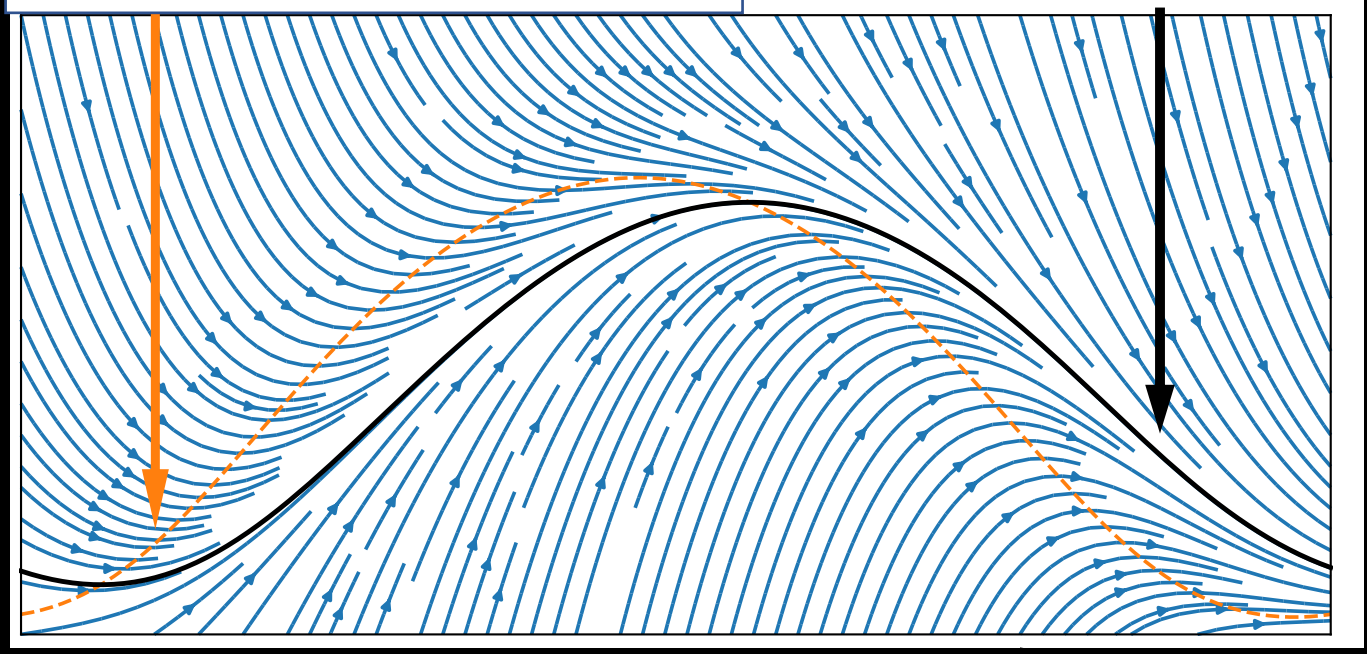


Summary

- Complex dynamics possible with simple regulation
- Regulation form determines balance point and attractor







Questions? Comments?
Hiring? Vous engagez?

leaves.and.lemmas@gmail.com

Slides available at:

www.leaves-and-lemmas.com