Modeling vegetation pattern formation

Vegetation biomass change in time	=	Vegetation growth	–	Vegetation mortality	+	Seed dispersal or clonal growth	
Soil-water change in time	=	Infiltration of surface water	–	evaporation	–	Water uptake by plant roots	+ Soil-water diffusion
surface-water change in time	=	precipitation	–	Infiltration of surface water	–	evaporation	+ Overland water flow

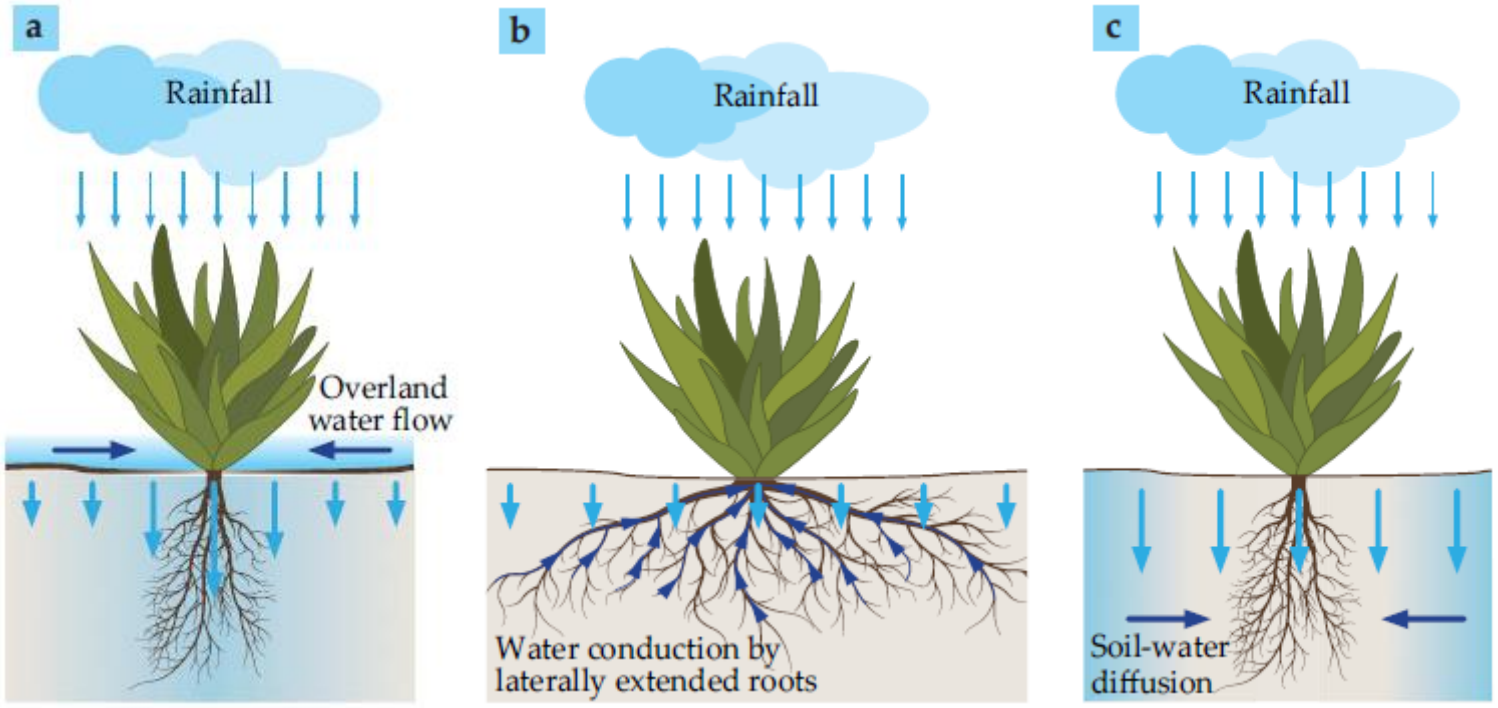
Three forms of water transport:

Overland water flow
Water conduction by lateral roots
Soil-water diffusion

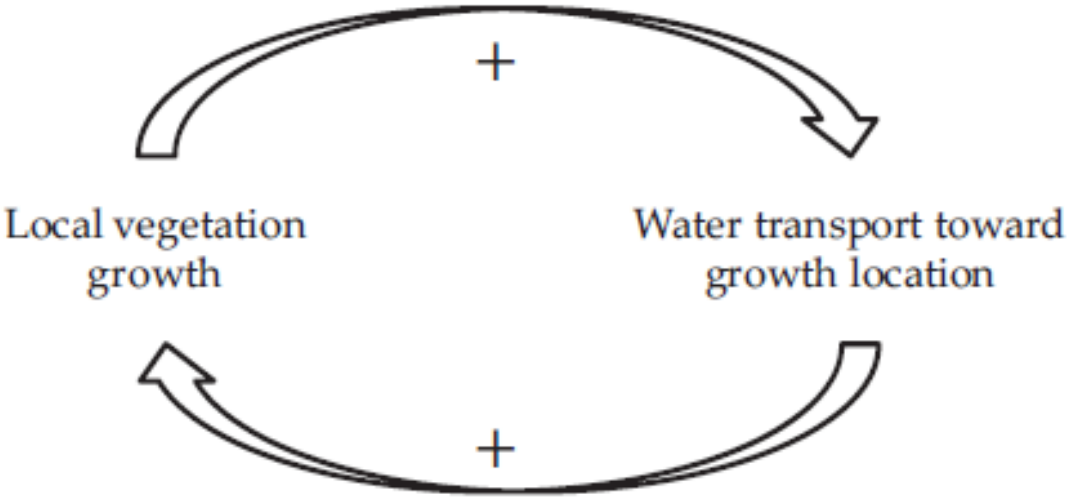
Activator-inhibitor system:

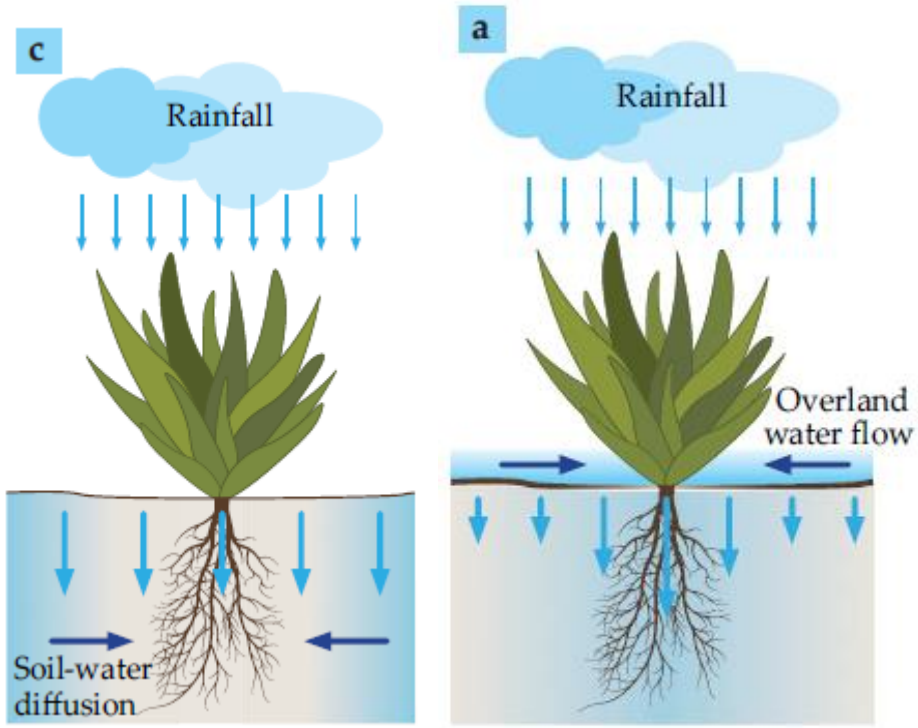
Activator = biomass – grows exponentially by reproduction

Inhibitor = lack of water



Positive feedback loop that drives instability of uniform vegetation to periodic patterns when precipitation is low enough





Amplifies random small perturbations:

Perturbations that grow are spatially nonuniform: the feedback loop enhances local vegetation growth but inhibits growth in the surroundings

⇨ Scale-dependent feedback