Lecture 13

Models as Narratives

Geog 490/590
Spatial Modeling
Spring 2015

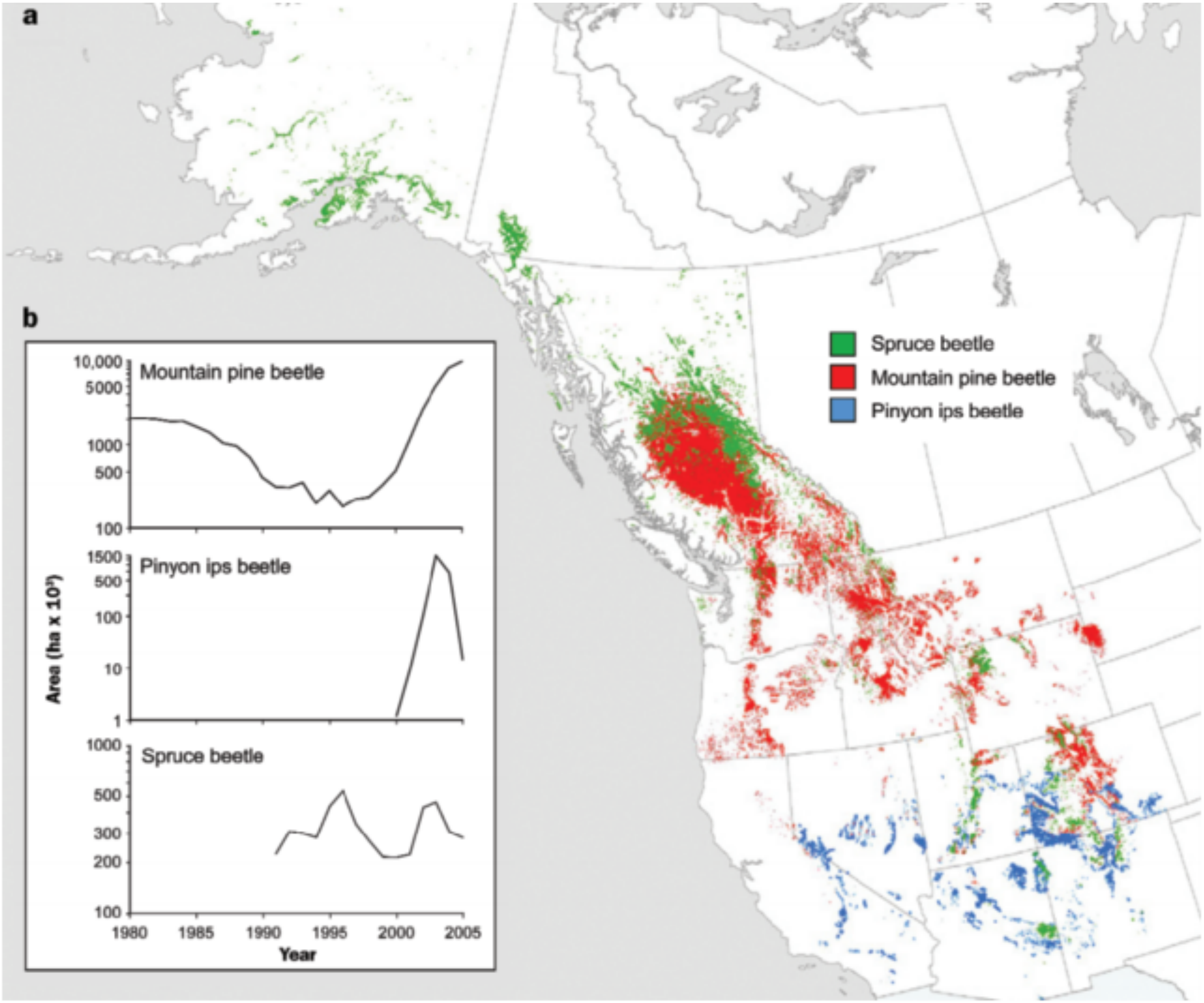


Figure 1. Recent mortality of major western conifer biomes to bark beetles. (a) Map of western North America showing regions of major eruptions by three species. (b) Sizes of conifer biome area affected by these three species over time. Data are from the Canadian Forest Service, the British Columbia Ministry of Forests and Range, and the US Forest Service.

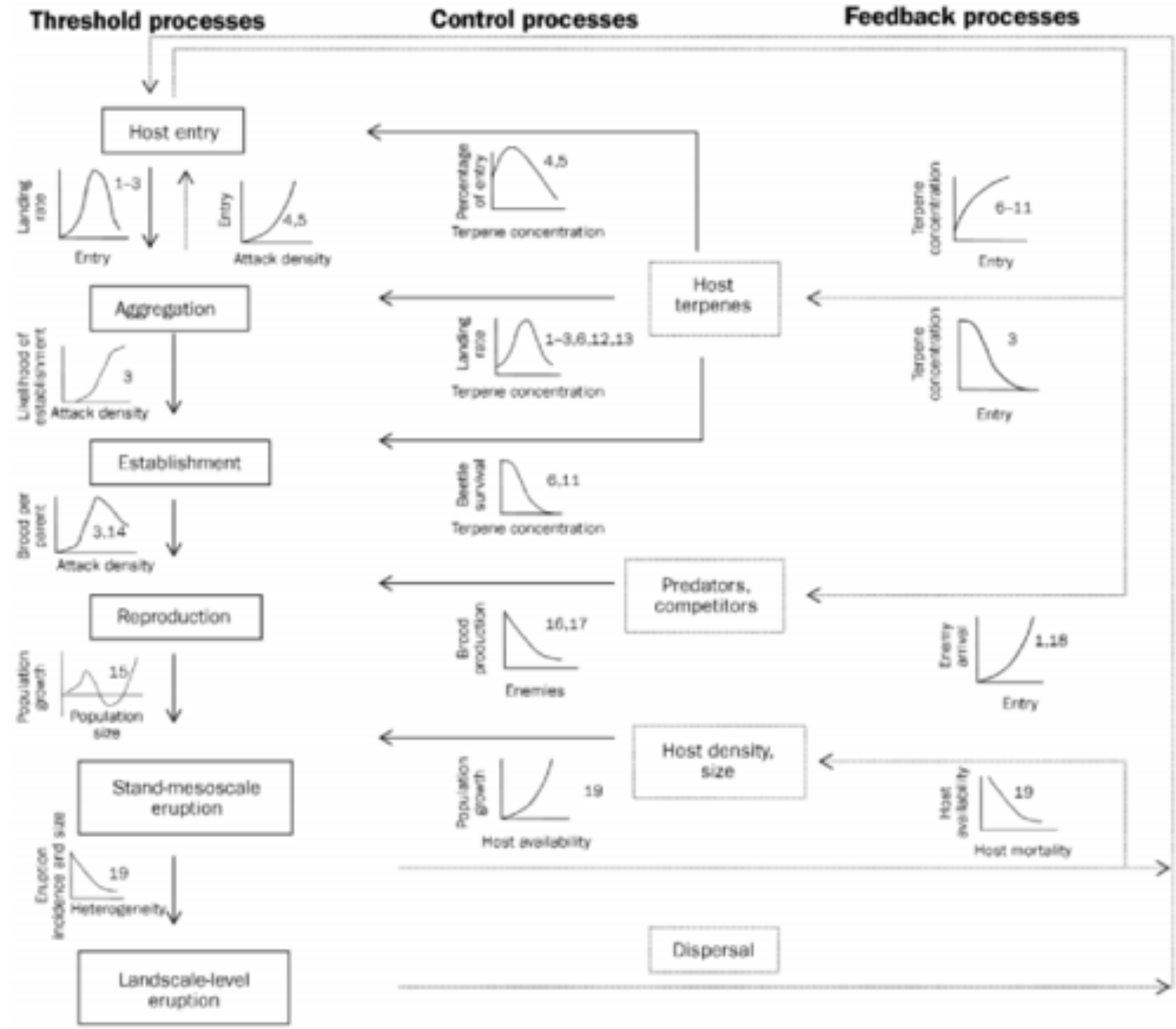


Figure 3. Opposing rate dynamics, mechanistic underpinnings, and feedbacks for the threshold processes depicted in figure 2. The key relationships defining whether beetles progress from one level to the next are illustrated between the solid boxes. These are affected by multiple factors, and exert feedbacks (dotted lines). Feedback can be positive, such as an entered beetle attracting more beetles; negative, such as successful reproduction depleting the availability of suitable trees; or both, such as entry into trees inducing defensive responses that can terminate attacks, but also depleting defenses by severing resin ducts and vectoring fungi. Once a threshold is breached, prior controlling factors exert little effect. For example, despite the ability of tree defenses to terminate attacks, they cause minimal beetle mortality if they are exhausted by mass attack. In each illustration, empirical support for the generalized curve is cited. For simplicity, a number of complex relationships are not illustrated. Among these, interactions among microbial symbionts have variable consequences to beetles (Klepzig and Six 2004, Six and Bentz 2007), reproduction is directly related to phloem thickness but phloem thickness is generally correlated with defensive capability (Safranyik and Carroll 2006), nonterpenoid compounds contribute to defense (Klepzig et al. 1996, Franceschi et al. 2005, Bonello et al. 2006), beetle development rate responds to temperature in a nonlinear fashion (Bentz et al. 1991), and the effects of precipitation on terpene content may be curvilinear (Lorio et al. 1990). Examples of each relationship are indicated by numbers: 1 (Wood 1982), 2 (Sandstrom et al. 2006), 3 (Raffa and Berryman 1983), 4 (Wallin and Raffa 2004), 5 (Wallin and Raffa 2000), 6 (Raffa et al. 2005), 7 (Klepzig et al. 1996), 8 (Bohlmann et al. 2000), 9 (Martin and Bohlmann 2005), 10 (Huber et al. 2004), 11 (Raffa and Smalley 1995), 12 (Seybold et al. 1995), 13 (Erbilgin et al. 2003), 14 (Raffa 2001), 15 (Mawby et al. 1989), 16 (Reeve 1997), 17 (Turchin et al. 1999), 18 (Raffa and Dahlsten 1995), and 19 (Safranyik and Carroll 2006). For more comprehensive documentation of these relationships, see Raffa and colleagues (2005).

Generative Modeling

Generative Modeling: models that simulate the order of low-level events that produce system (global)-level patterns.

Generative Modeling

The Generative Scientist: an individual who understands how simple low-level interactions potentially lead to complex system-level patterns.

Generative Modeling

Epistemology: the theory or study of knowledge.

Generative Modeling

"The increasing use of computer simulation modelling brings with it epistemological questions about the possibilities and limits of its use for understanding spatio-temporal dynamics of social and environmental systems."

Millington et al. 2012

Generative Modeling

"Here, we discuss how the representational framework generative simulation modelling provides influences its epistemology and how we learn from it."

Millington et al. 2012

Event-Driven Models

"Generative simulation models are event-driven in the sense that they simulate sequences of low-level events that produce system-level patterns."

Millington et al. 2012

Narrative

"…narratives (i.e., stories) concern chains of events and/or actions – perhaps partially teleologically linked – leading to a conclusion (i.e., outcome) that is not predictable as a consequence of the interposition of a multitude of contingent events"."

Abell et al. 2004

Narrative Explanation

“Narrative explanation shows how a focal event or state came to occur by fitting it into a coherent, causal, account of a sequence of preceding events and states. In some instances the purpose of narrative explanation is to establish that certain sequences of events could, potentially, cause the focal event or state, but in others the intention is to show how and why it did, actually, come about”

Millington et al. 2012

PNAS PNAS PNAS PNAS

CrossMark

Using narratives and storytelling to communicate science with nonexpert audiences

Michael F. Dahlstrom[1]

Greenlee School of Journalism and Communication, Iowa State University, Ames, IA 50010

Edited by Dietram A. Scheufele, University of Wisconsin-Madison, Madison, WI, and accepted by the Editorial Board April 7, 2014 (received for review November 1, 2013)

Although storytelling often has negative connotations within science, narrative formats of communication should not be disregarded when communicating science to nonexpert audiences. Narratives offer increased comprehension, interest, and engagement. Nonexperts get most of their science information from mass media content, which is itself already biased toward narrative formats. Narratives are also intrinsically persuasive, which offers science communicators tactics for persuading otherwise resistant audiences, although such use also raises ethical considerations. Future intersections of narrative research with ongoing discussions in science communication are introduced.

persuasion | ethics

Storytelling often has a bad reputation within science (1). Viewed as baseless or even manipulative, stories are often denigrated with statements such as, "the plural of anecdote is not data." Such a perspective is valuable within the context of scientific data collection to underscore the important difference between making informed generalizations from systematically sampled populations versus overgeneralizations from small and often biased samples.

certain factors that distinguish narrative as a communication format. Narratives follow a particular structure that describes the cause-and-effect relationships between events that take place over a particular time period that impact particular characters. Although there exist more nuanced factors that scholars can use to further determine the narrativity of a message (6–8), this triumvirate of causality, temporality, and character represents a fairly standard definition of narrative communication. Such a definition is independent of content and so narratives can be present within almost any communication activity or media platform. Obvious examples include interpersonal conversation, entertainment television programs, and news profiles, but narratives can also present themselves within larger messages as testimonials, exemplars, case studies, or eyewitness accounts.

Narratives are often contrasted with other formats of communication, such as expository or argumentative communication (7), or with other types of explanations, such as descriptive, deductive, or statistical (6). However, more generally, narratives are often contrasted with the logical-scientific communication underlying most of the sciences (3, 9). Three areas in particular where logical-scientific and narrative formats differ are in their

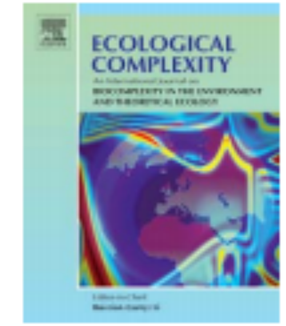
ECOLOGICAL COMPLEXITY 3 (2006) 171–182

ELSEVIER

available at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.elsevier.com/locate/ecocom



Viewpoint

The nature of ecological complexity: A protocol for building the narrative

A.J. Zellmer [a], T.F.H. Allen [b,*], K. Kesseboehmer [b]

[a] Ecology and Evolutionary Biology Department, University of Michigan, 830 N. University, Ann Arbor, MI 48109-1048, United States
[b] Botany Department, University of Wisconsin, 430 Lincoln Drive, Madison, WI 53706-1381, United States

ARTICLE INFO

Article history:
Received 15 May 2006
Received in revised form
2 June 2006
Accepted 3 June 2006
Published on line 1 August 2006

Keywords:
Complexity
Essence
Epistemology
Narrative
Rosen modeling relation
Strange attractor
Sustainability

ABSTRACT

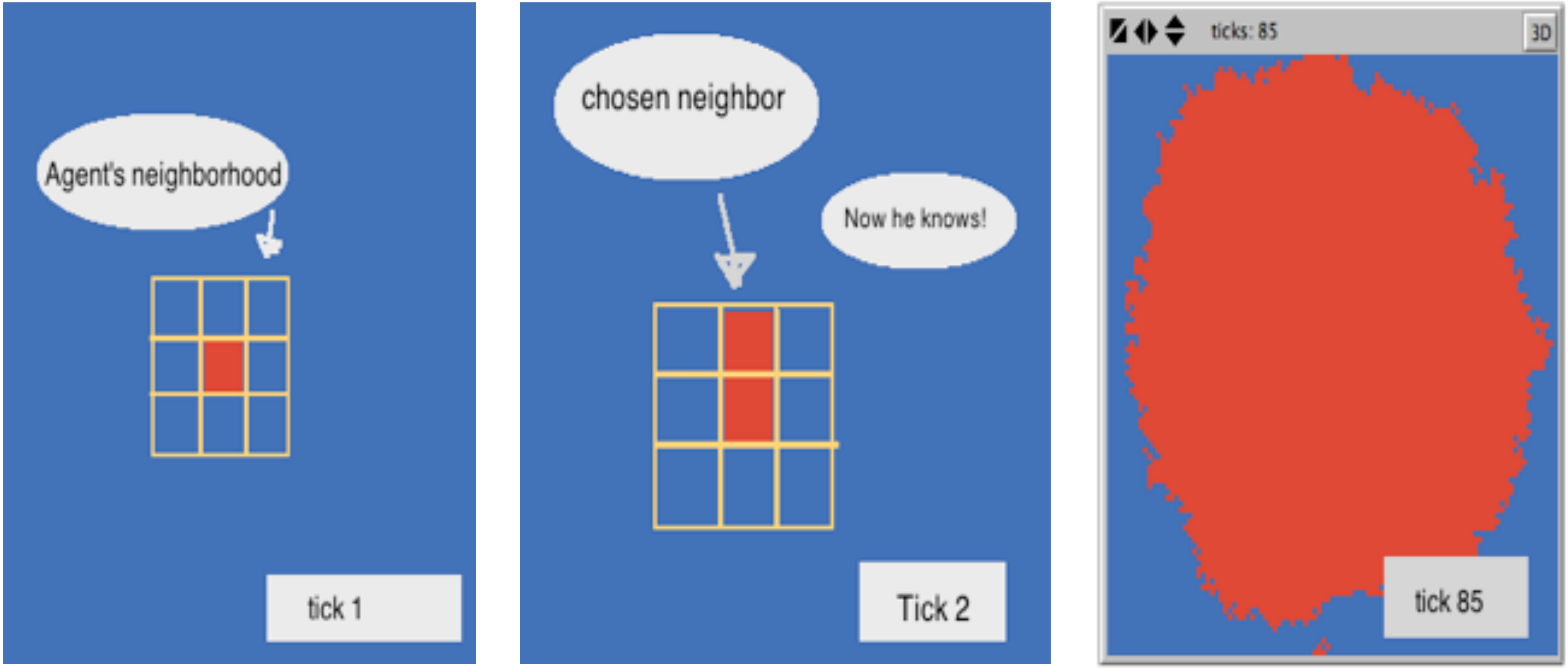
We show that a realist view of ecology does not pay sufficient attention to the role of the observer dealing with complex systems. Complexity after Rosen [Rosen, R., 2000. Essays on Life Itself. Columbia University Press, New York, p. 257] is something that cannot be modeled. Conventional properties ascribed to complex systems are in fact prescriptions for what it takes to make a complex system yield to a model structure, to make it a simple system, albeit a complicated one. Complexity is not a material property, but turns rather on the question that is posed. It is normative to the degree that complexity arises from the lack of a paradigm, lack of an accepted set of modeling assertions. We develop a scheme for making complexity tractable. Our protocol arises from Pattee [Pattee, H., 1978. The complementarity principle in biological and social structures. J. Soc. Biol. Struct. 1, 191–200] laws and rules, Allen and Hoekstra [Allen, T.F.H., Hoekstra, T.W., 1992. Toward a Unified Ecology. University of Columbia Press, New York] scale versus type, observation protocol versus observed structure and Rosen [Rosen, R. 2000. Essays on Life Itself. Columbia University Press, New York, p. 257] essence versus realization. In a pair of cycles, one reinforces patterns of model building, and the cycle of the other deals with the changes that appear in the essence of that which is modeled. We use narrative to rise above the local constraints of models. In the end, we give an application in a salmon fishery as we build a narrative from a set of separate models.

People are always tellers of tales.
They live surrounded by their stories and
The stories of others; they see everything
That happens to them through those stories
And they try to live their lives as
If they were recounting them.

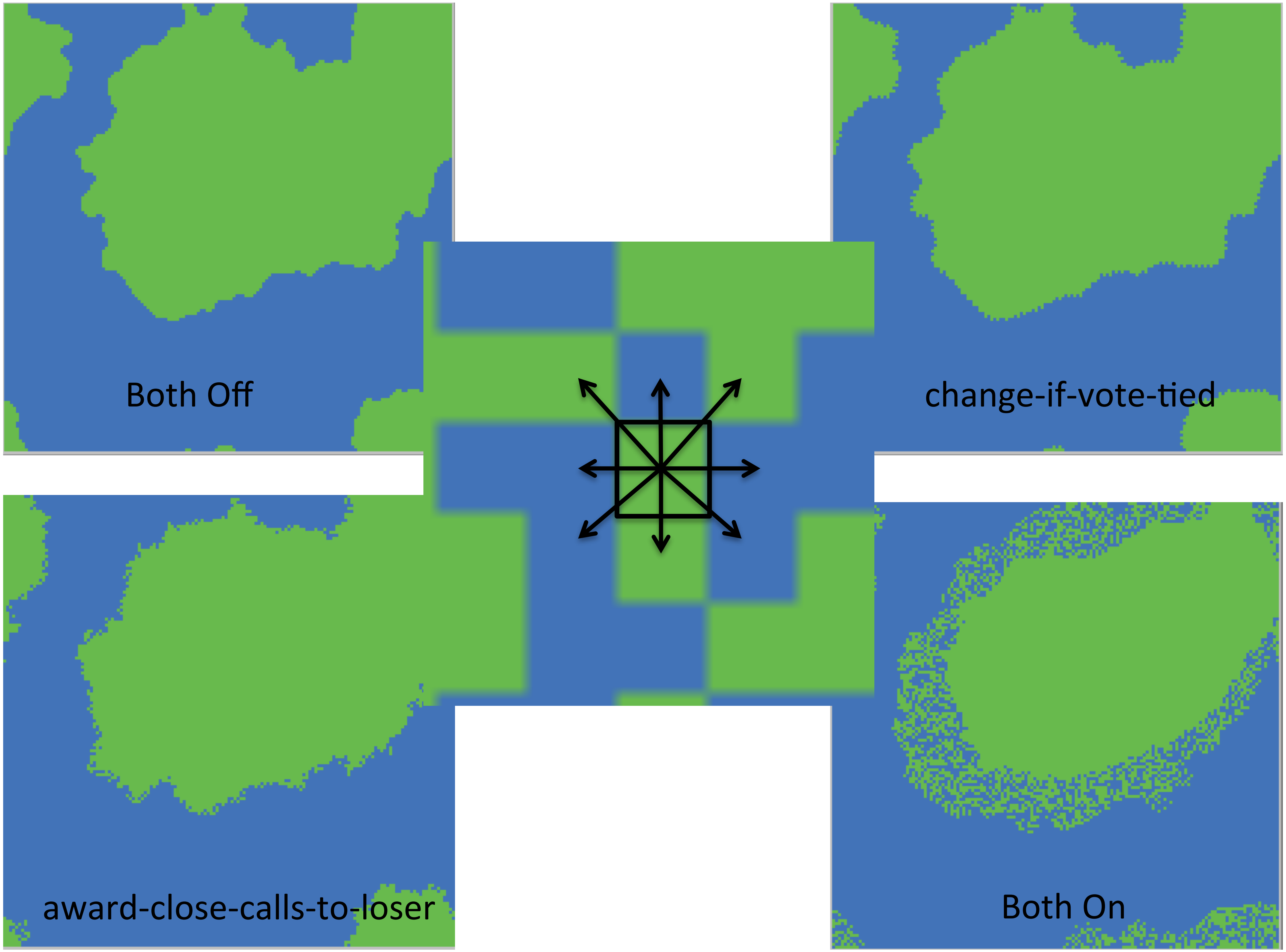
Webster and Mertova 2007

Presentations

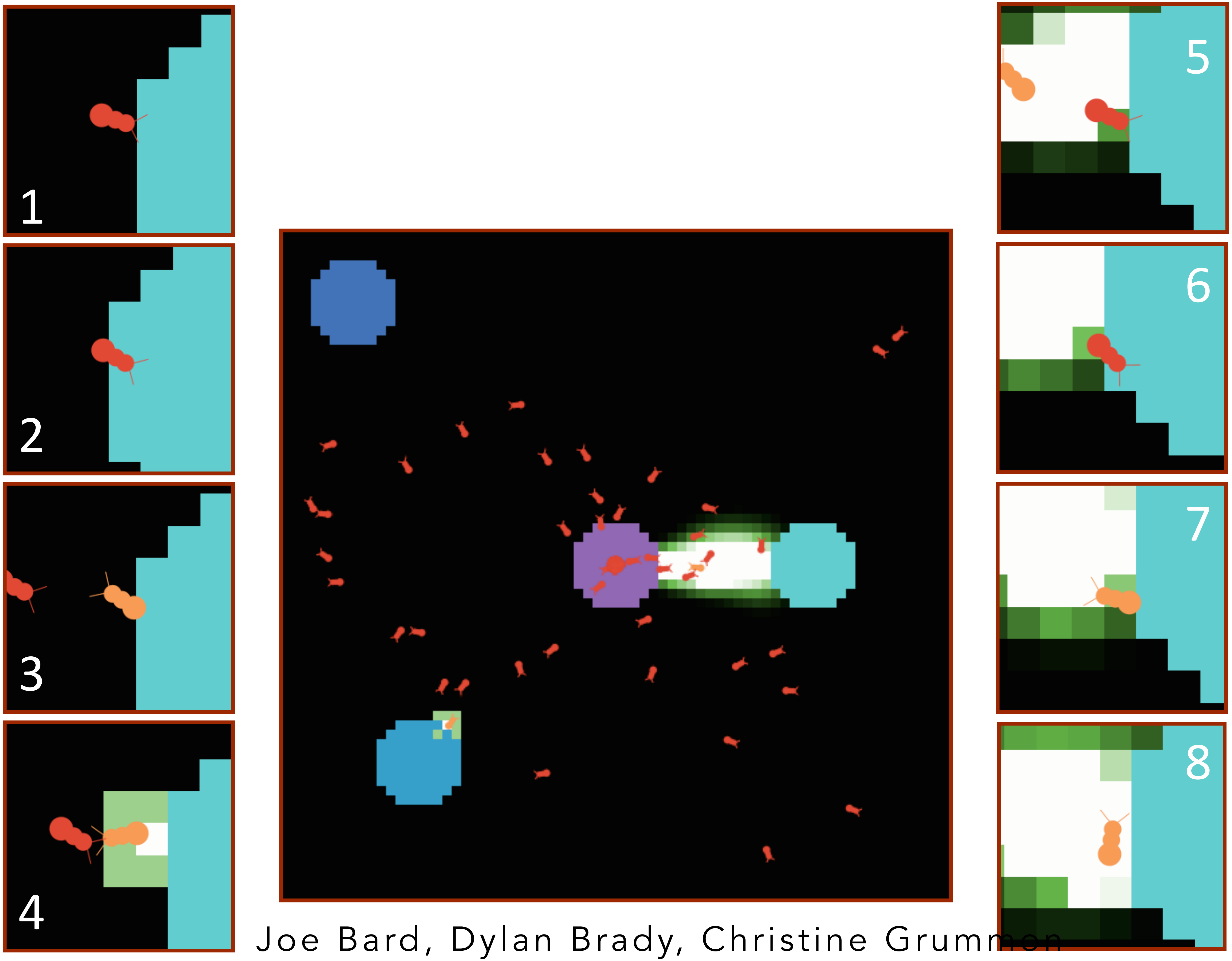
Rumor Mill:


Agent's neighborhood
tick 1
chosen neighbor
Now he knows!
Tick 2
ticks: 85
3D
tick 85

Voting Model Super Slide



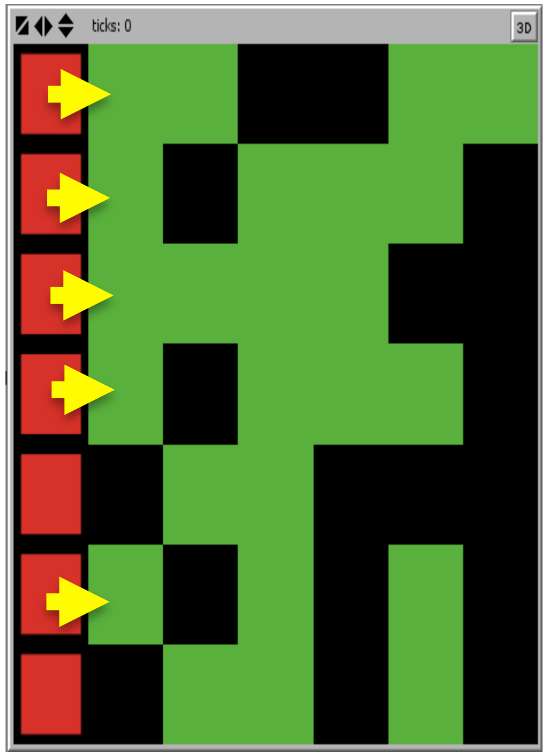
Adam Zukaitis & Chris Strub

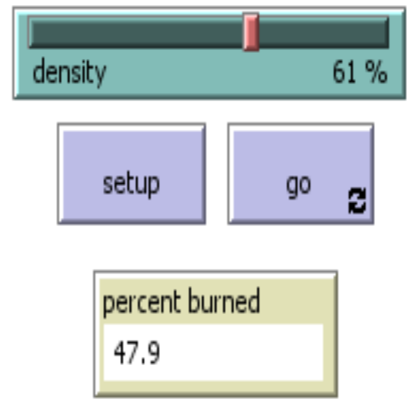


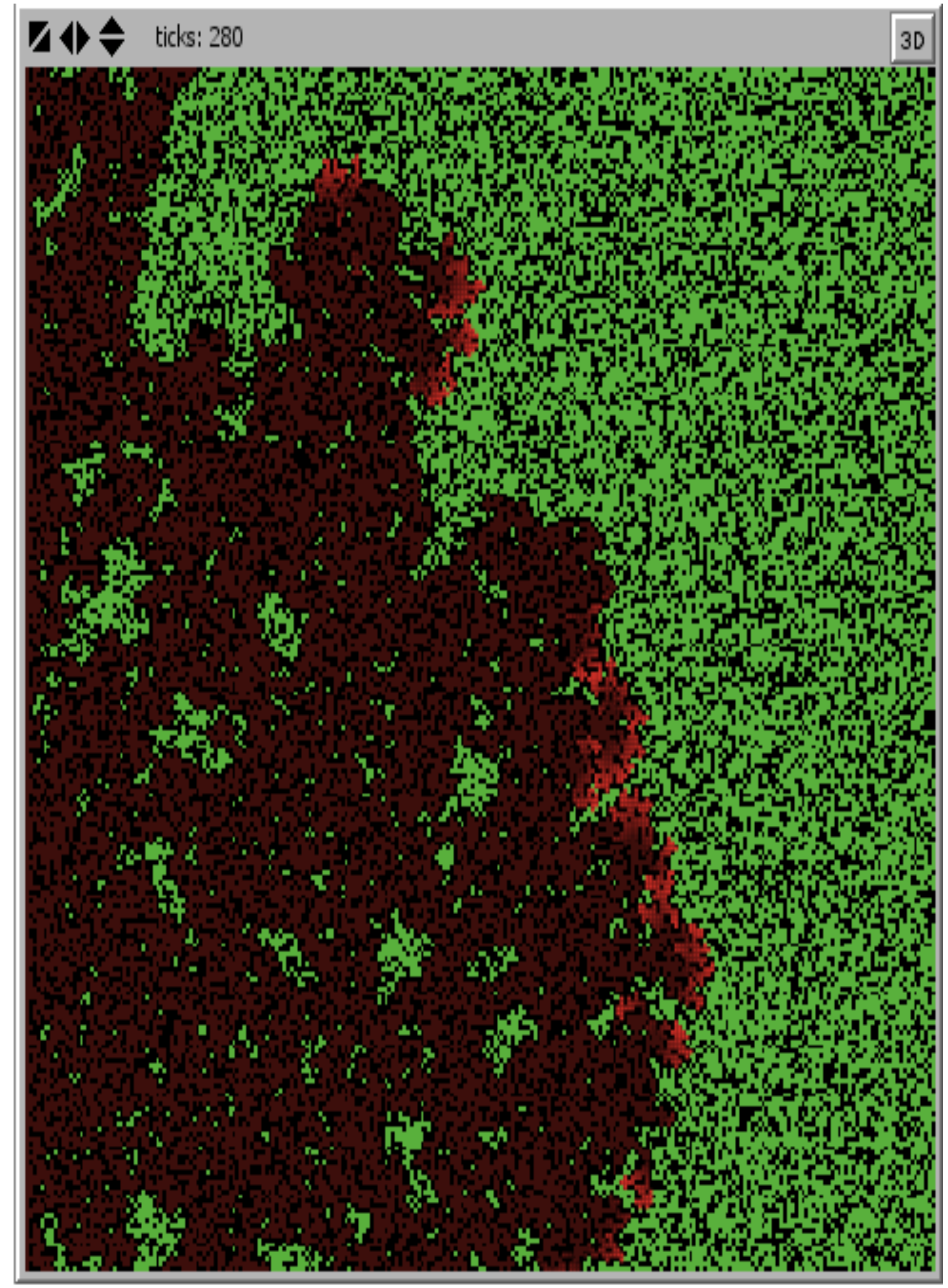
Joe Bard, Dylan Brady, Christine Grummon

Density dependence

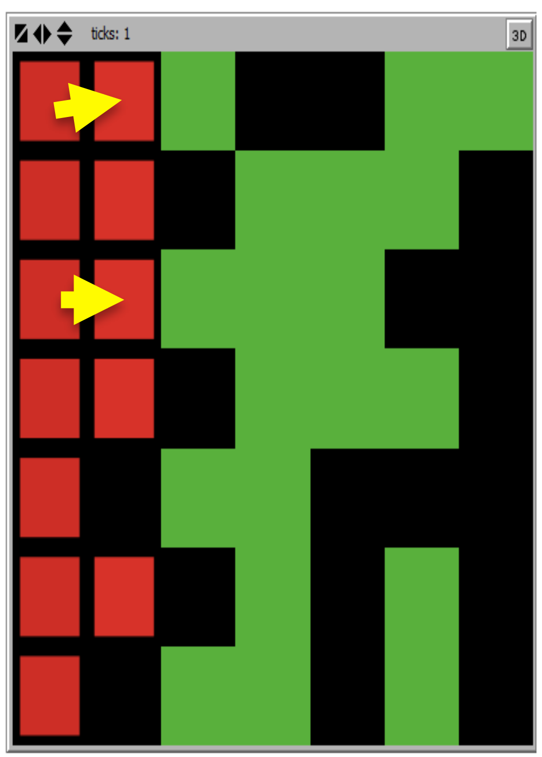
T=0



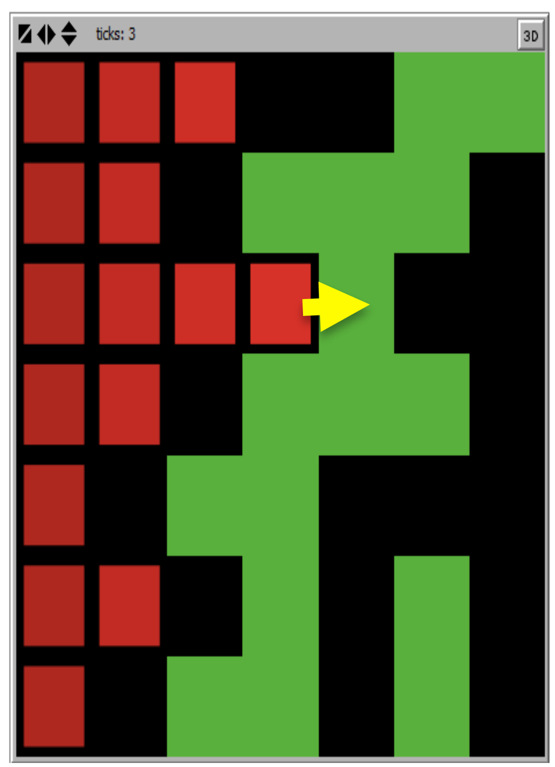




T=2

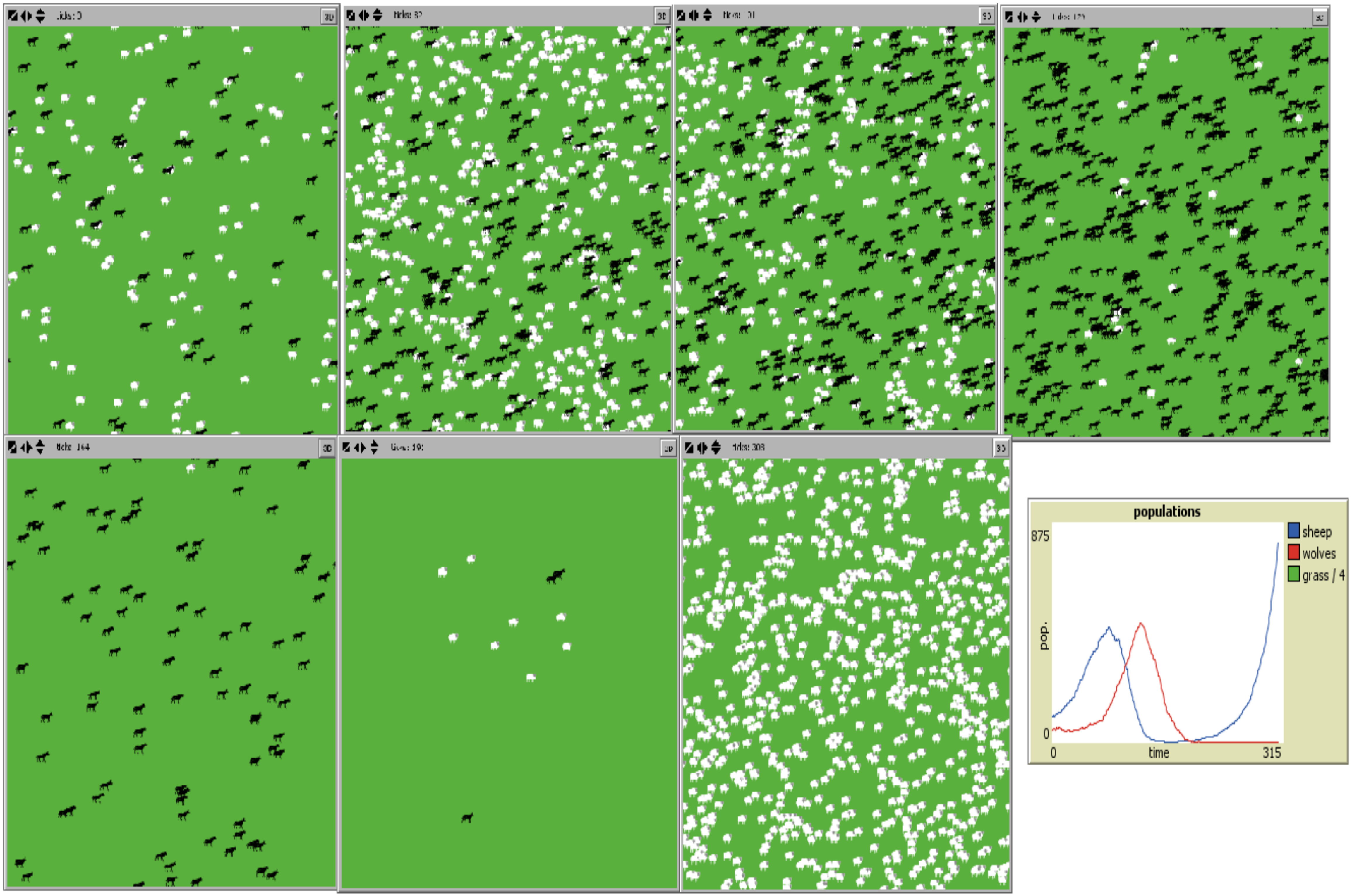


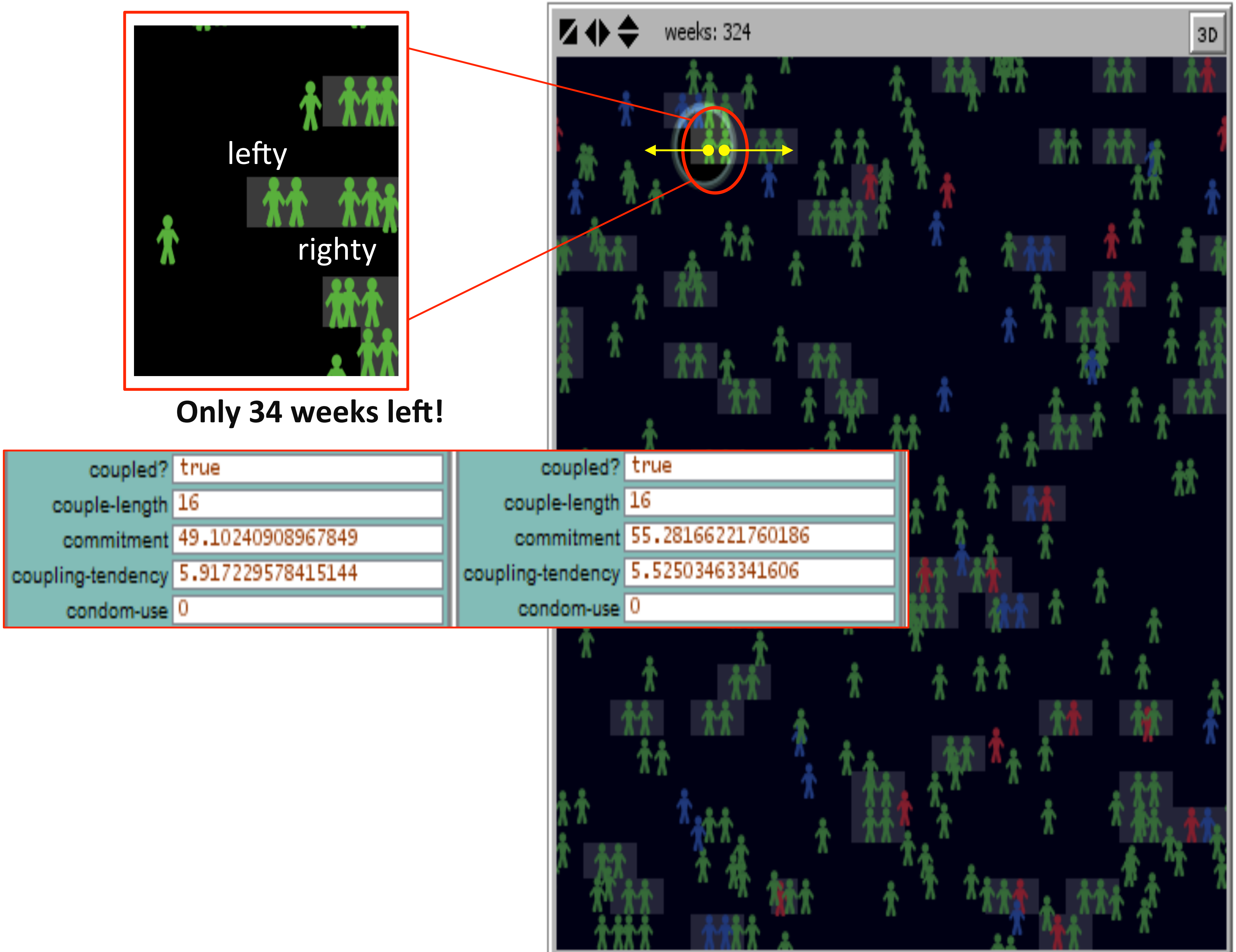
T=4



$T_{final} = ?$

Planet of the sheep

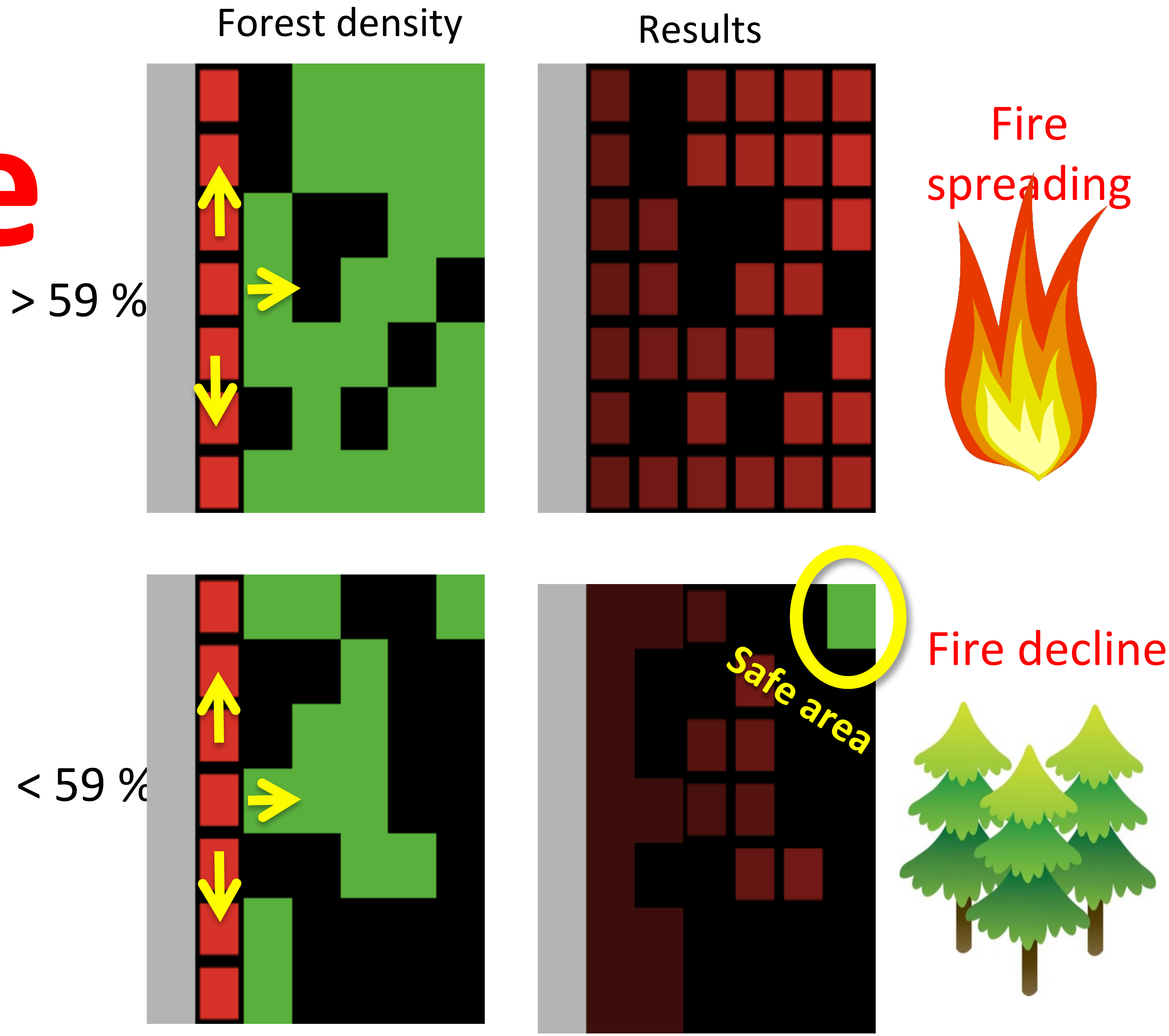




weeks: 324
3D
lefty
righty
Only 34 weeks left!
coupled? true
couple-length 16
commitment 49.10240908967849
coupling-tendency 5.917229578415144
condom-use 0
coupled? true
couple-length 16
commitment 55.28166221760186
coupling-tendency 5.52503463341606
condom-use 0

Fire

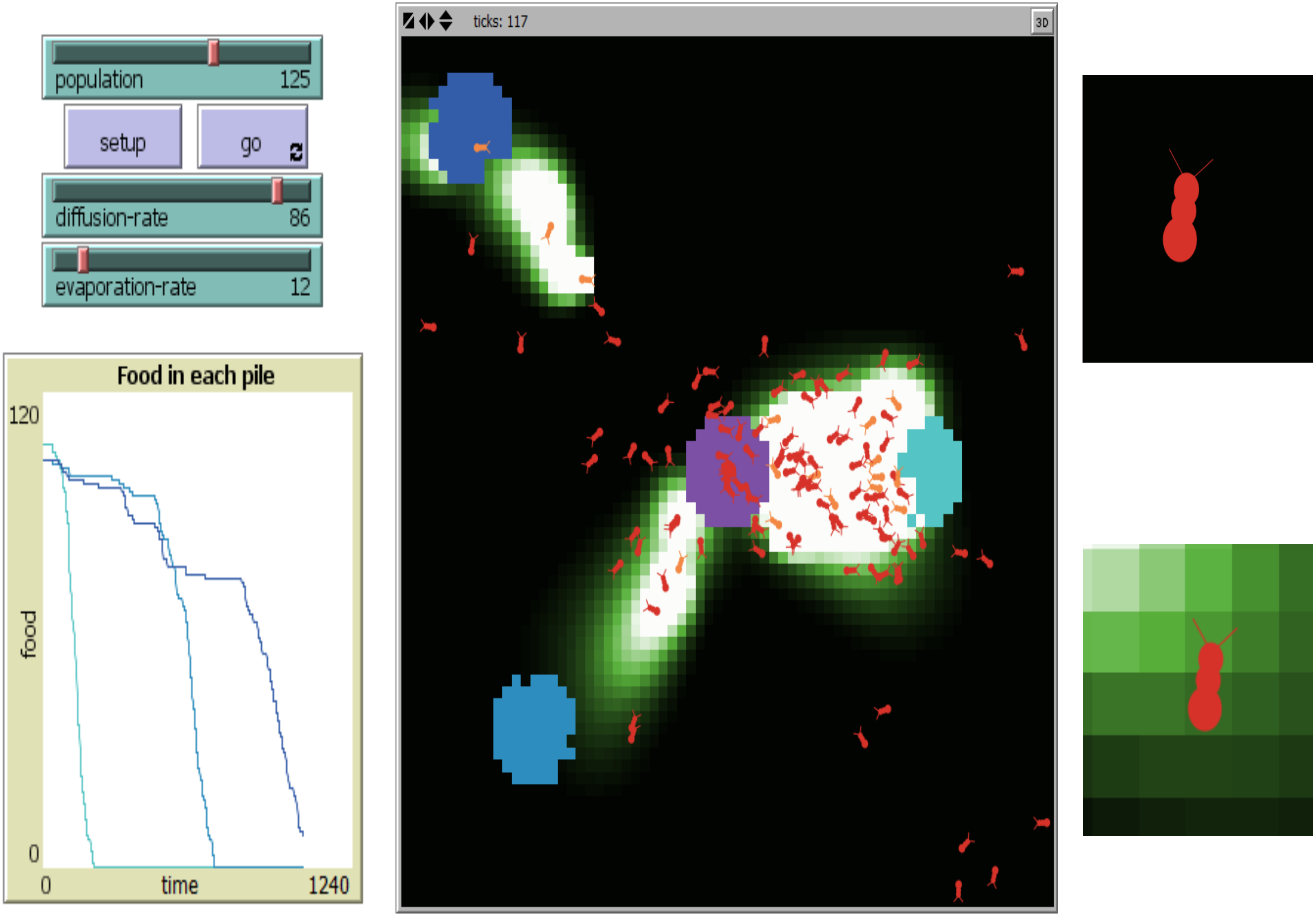
Influence of forest density to fire spreading



Fire model NetLogo

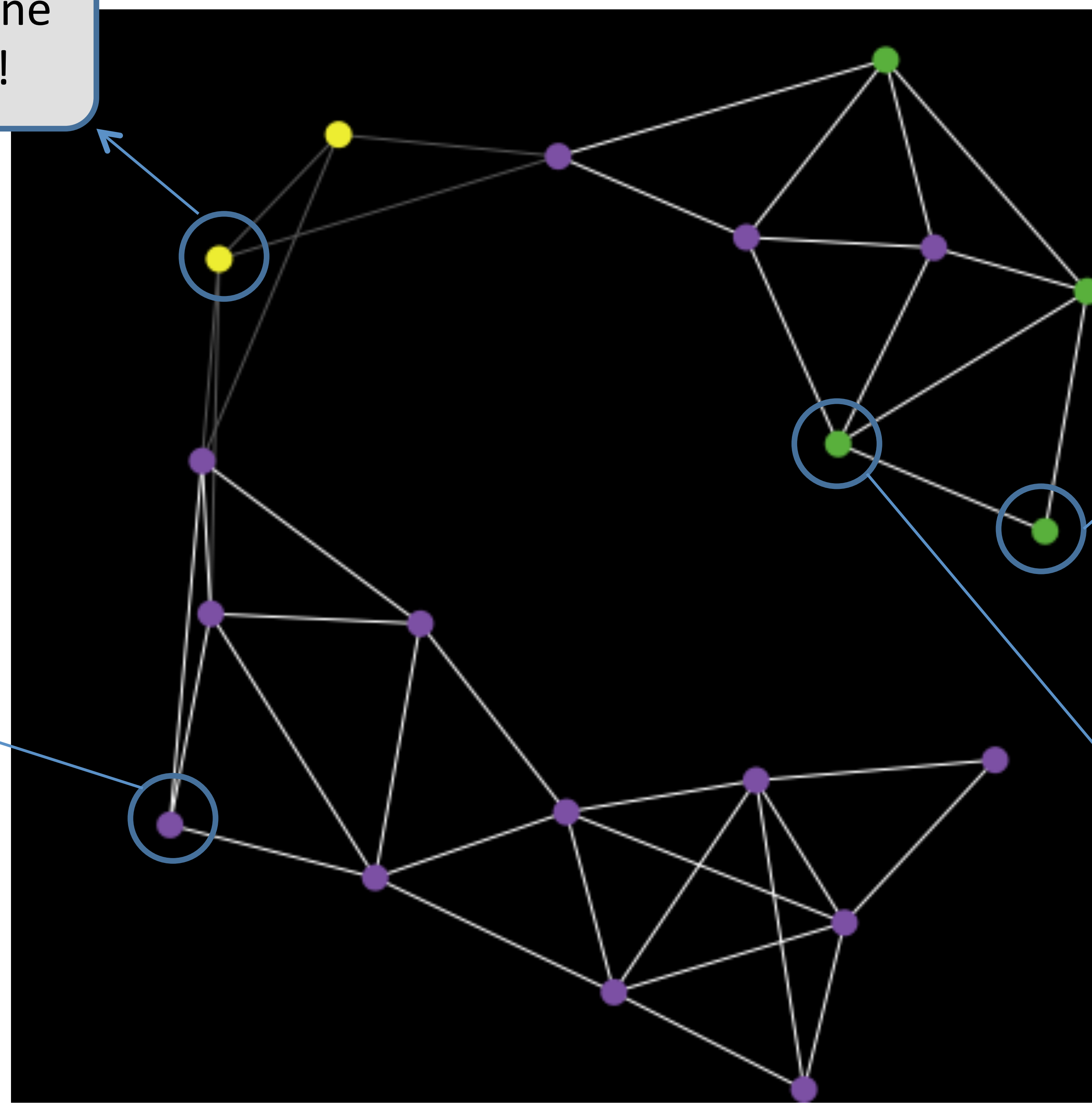
Wilensky, U. (1997). NetLogo Fire model. http://ccl.northwestern.edu/netlogo/models/Fire. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

Ant Foraging, Food, Pheromones, Chemo-taxis and Feedback



Virus on a Network Model Narrative

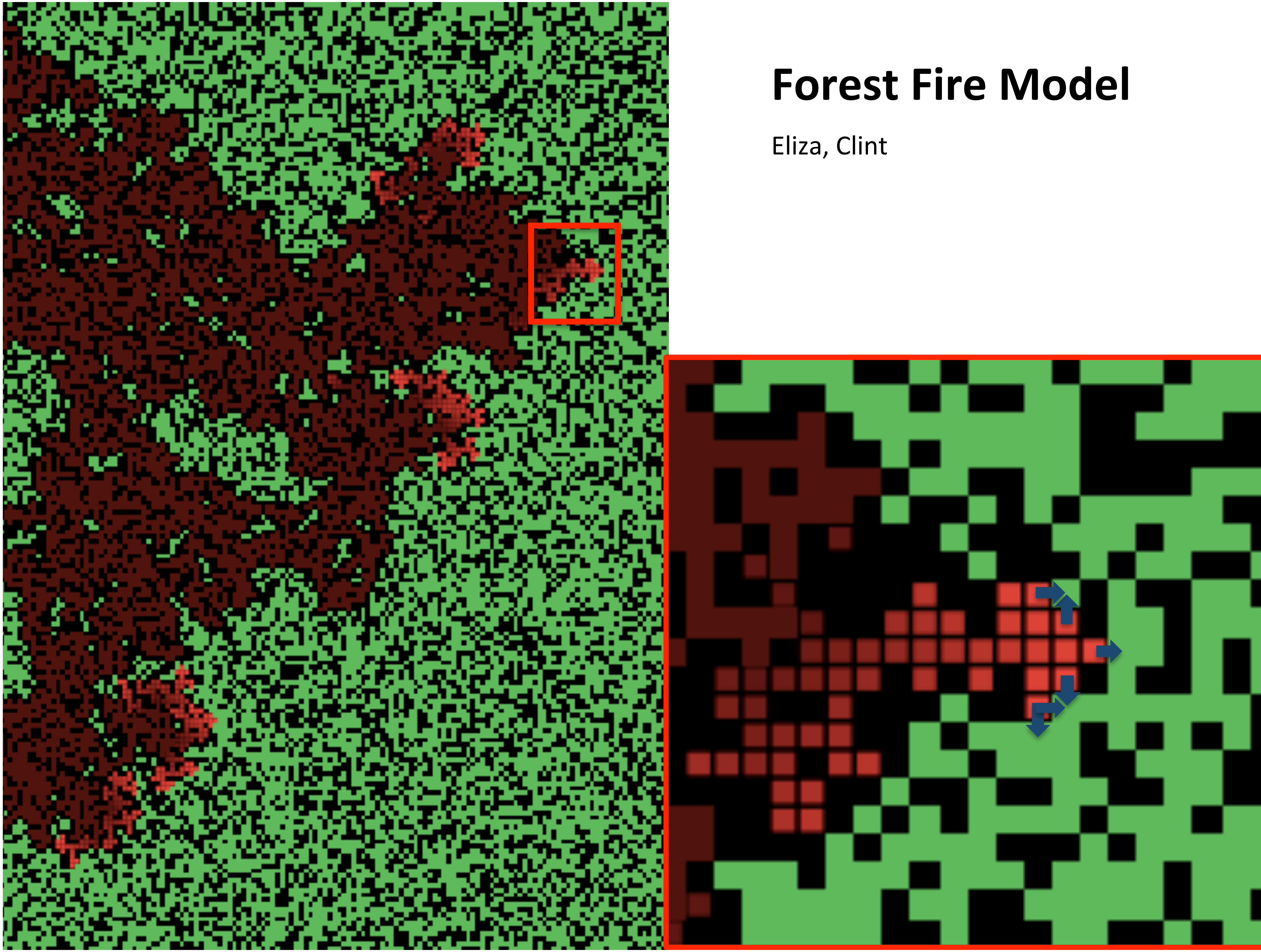
I'm immune forever!



I'm infected, and want to infect any of my neighbors if they become healthy, but I could also recover or become immune.

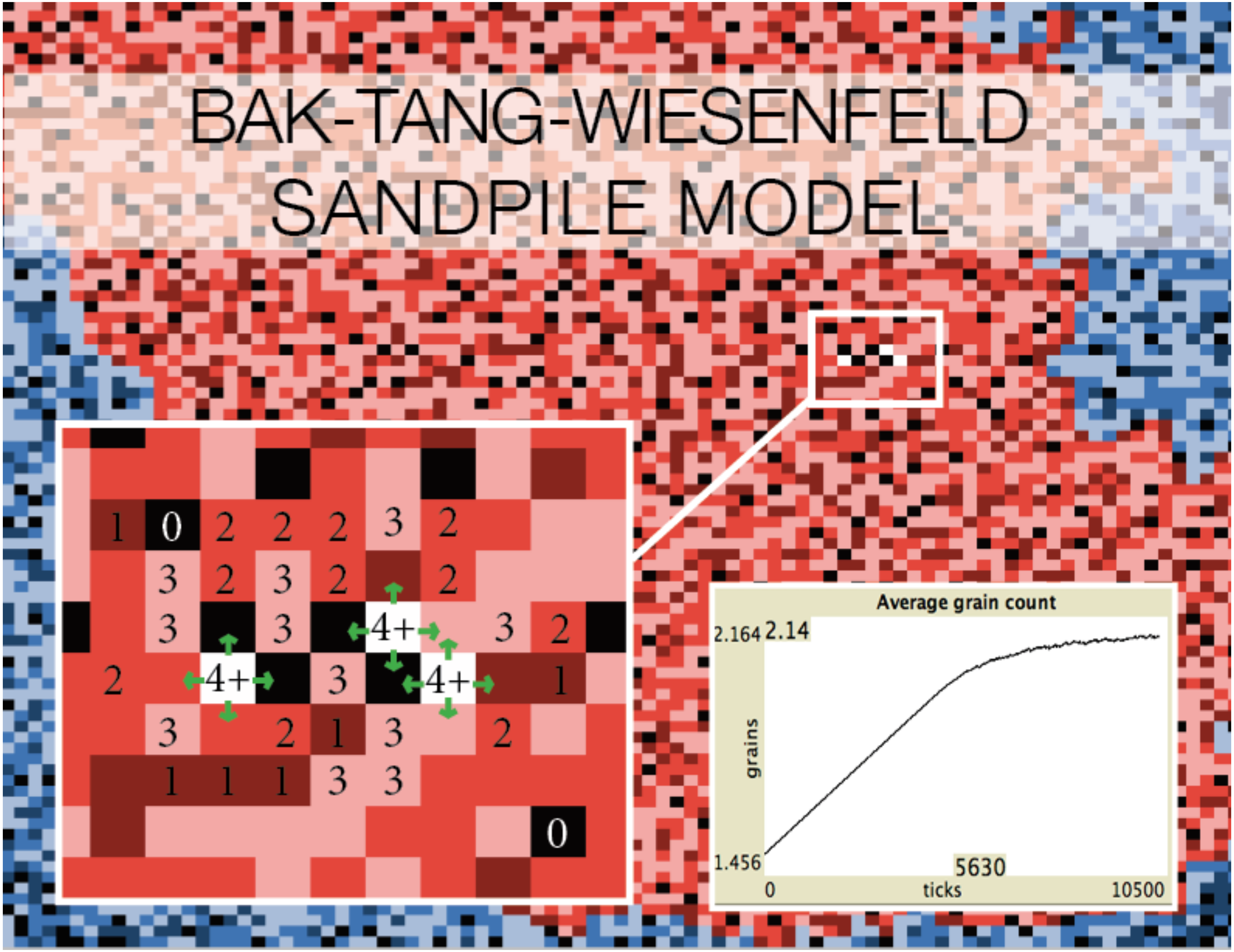
I'm healthy with no chance of getting infected, but I could become immune!

I'm healthy, but two of my neighbors want to infect me. Hopefully I'll become immune!



Forest Fire Model

Eliza, Clint


BAK-TANG-WIESENFELD
SANDPILE MODEL
1 0 2 2 2 3 2
3 2 3 2 2
3 3 4+ 3 2
2 4+ 3 4+ 1
3 2 1 3 2
1 1 1 3 3
0
Average grain count
2.164
2.14
grains
1.456
5630
0
ticks
10500