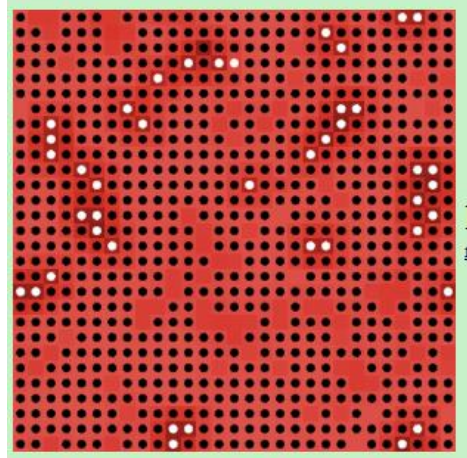


ANTH 490: AGENT-BASED MODELING OF SOCIAL- ECOLOGICAL SYSTEMS

M, W, F – 2:40 to 3:30
Online

Prof. Colin Thor West
Office: Alumni 409D
Office Hours: Wed., 11:30 -1:00 &
Tues., 4:00 – 5:30
Email: ctw@email.unc.edu



Course Description

This course exposes students to the potential of using agent-based modeling (ABM) to explore social-ecological system dynamics. ABM is used across the social and natural sciences and students will gain both theoretical and applied knowledge in how to use it. Students will acquire skills in modeling social-ecological systems, writing code, building models and interpreting results. They will do so using the ABM program Netlogo (<https://ccl.northwestern.edu/netlogo/>).

Course Format

This online course is a hybrid lecture-lab partially-flipped classroom. This means that students and Professor West meet online for class where part of each meeting involves lecture and part of it involves “lab.” Typically, West will demo certain ABM modeling steps. Through guided practice, students follow these same steps to begin the lab. They then complete the lab assignment outside of class and upload their model or output to Sakai through the Assignments tool. Labs are supplemented with case studies from ecological anthropology. Students do an in-depth case study of pesticides and seeds in India by reading the ethnography *Cultivating Knowledge . . .* (Flachs, 2019). In the latter part of the class, students design and create their own ABM to demonstrate their understanding of course material.

Assignment Descriptions

Labs – There will be approximately six labs in this course. Each is designed to teach students basic skills in Netlogo. Each lab builds on the previous to extend learning. In most cases, West will demo part of the lab in Wednesday’s lecture and get students started. They will then continue the lab during class time on Friday when West is available to assist. The completed lab is due the FOLLOWING Tuesday evening by 12 midnight. Most labs consist of a working model in Netlogo with a brief write-up that are uploaded to Sakai using the Assignments tool. Since each lab builds on the previous, the cumulative effect of missing one compounds itself with each subsequent lab. Labs that are more than 24 hours late receive only partial credit and minimal feedback from West. **It is imperative that labs be turned in on time and that students do not fall behind!**

Quizzes – There will be two quizzes. These quizzes are taken in class using Sakai. They will assess basic knowledge of Netlogo and course content using multiple choice questions and short answers. They are timed and will take approximately 20 minutes.

In-class Exams – There will be two in-class exams. One of these will be the mid-term that consists of a problem set you will have to solve along with a short online exam. The other will be a Final Exam (discussed below), which will be similar.

Note: Exams take place during class time. Only medical and family emergencies are valid excuses for missing quizzes and exams. Exams must be made up during office hours with West within one week of the missed quiz or exam. Otherwise, the grade becomes a zero.

Classic ABM presentation – Cultural anthropologists, ecologists, economists and archaeologists have developed several classic ABMs over the years. Students will read one of these classic ABM papers and then present the model in class. Almost all these models are available through the CoMSES Network and their Computational Model Library (<https://www.comses.net/>). Others are available through the NetLogo Library or NetLogo User Community Models. These presentations will be approximately 20 minutes long and include brief Powerpoint presentation with a demo of the model. Handouts will describe this assignment in greater detail.

ABM final project – Students will design and create an ABM based on their own interests. This could be model of some project they are currently working on. Or, it could be based on some case study from this or another class. Students will present their ABM in the latter part of class and include documentation similar to models featured in the Netlogo Models Library (<http://ccl.northwestern.edu/netlogo/models/index.cgi>). Handouts will describe this final project in greater detail.

Participation – All students are expected to attend all classes, read all of the readings, and come to class prepared to discuss them. This accounts for 10 percent of your final grade! West will use the Attendance feature in Zoom to record your online presence. He will also track your participation based on answering questions, contributing to discussion, and asking questions. He will post your participation at multiple points in the semester. West will also accommodate students affected by the pandemic (see <https://eoc.unc.edu/covid-19accommodations/>).

Grading – Your grade will be based on one map quiz, two exams, one presentation, a final paper and class participation. The weights of each component are:

Assignment	Percent
Labs	20%
Quizzes	10%
Mid-term	15%
Classic ABM presentation	10%
ABM Final Project	20%
Final Exam	15%
Attendance and Participation	10%

The final grade is determined as follows: A (93% or above); A- (90-92.49%); B+ (86-89.49%); B(83-85.49%); B- (80-82.49%); C+(76-79.49%); C(73-85.49%); C-(69.5-72.49); D(60-69%); F(<59%).

Honor Code – All students are expected to adhere to the UNC Instrument of Student Governance available at: <http://instrument.unc.edu/>. Any infraction of the Instrument will be dealt with according to UNC policies.

Professional communication – It is really important that everyone in class respect one another's time and recognize that we have a time and space dedicated for learning from one another. Class time should be used

for questions and concerns about class and course content. If you have additional needs, it is best meet with West during office hours and discuss these directly with him. This will be done using Zoom. Email is not an effective form of professional communication given that we have 2.5 hours each week together plus office hours. Please only email West if it is absolutely necessary so we can all maximize class time for everyone. Furthermore, please do so using Sakai and the Messages tool.

Additional needs or issues – Please make the instructor aware of any additional need or issues you may need him to be aware of early during the semester. Please meet with Dr. West during office hours. Alternatively, please consult UNC’s Center for Student Success and Academic Counseling (CSSAC - <http://cssac.unc.edu/>) or the UNC Office of Accessibility Resources and Service (<https://ars.unc.edu/>) and have their staff contact Dr. West to inform him of additional assistance you may need.

Titel IX Resources -- Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance (Adrienne Allison – Adrienne.allison@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.

Readings – Two books are required for class along with several articles. The books will be available at the UNC Bookstore as well as at online booksellers such as Amazon.com, Barnes and Noble, etc. Articles are available through the UNC Library and students must download them through the Library. Students must also download Netlogo from <https://ccl.northwestern.edu/netlogo/>.

BOOKS

Wilensky, Uri and William Rand. 2015. *An Introduction to Agent-based Modeling: Modeling Natural, Social, and Engineered Complex Systems with Netlogo*. Cambridge, MA: The MIT Press.

Flachs, Andrew. 2019. *Cultivating Knowledge: Biotechnology, Sustainability, and the Human Cost of Cotton Capitalism in India*. Tucson, AZ: The University of Arizona Press.

INITIAL ARTICLES

Lansing, J. Stephen and James N. Kremer. 1993. Emergent Properties of Balinese Water Temple Networks: Coadaptation on a Rugged Fitness Landscape. *American Anthropologist* 95(1):97-114.

West, Colin Thor. 2009. Domestic Transitions, Desiccation, Agricultural Intensification, and Livelihood Diversification among Rural Households on the Central Plateau, Burkina Faso. *American Anthropologist* 111(2):275-288.

MODELS

NetLogo User Manual - NetLogo models used in Labs and Tutorials can be found in the (<https://ccl.northwestern.edu/netlogo/docs/>)

Lansing-Kremer Model of Balinese Irrigation – This can be found and downloaded at CoMSES Network: <https://www.comses.net/codebases/2221/releases/1.2.0/>

Course Schedule

Note: The schedule and readings could change over the course of the semester. You will be informed of this in class. Please also check the Sakai site for announcements.

Week/theme	Readings	Assignments/activities
Week 1 - Introduction		
Aug. 10 – Class intro	-none-	Download NetLogo
Aug. 12 – Agent-based Modeling	Wilensky and Rand, Ch. 0	Excel ABM
Aug. 14 – ABM basics	Wilensky and Rand, Ch. 1	Netlogo model demo
Week 2 – Creating ABMs		
Aug. 17 – Simple models	Wilensky and Rand, Ch. 2	Sample Model: Party
Aug. 19 – Demo model	Netlogo User Manual	Tutorial 1 and 2
Aug. 21 – African languages III	“	Lab 1 – Tutorial 3 Turtles and Patches
Week 3 – ABM Case Studies I		
Aug. 24 – Balinese Water Temples	Lansing and Kremer 1993	
Aug. 26 – Lansing-Kremer Bali Model	“	Demo Kremer-Lansing Bali Model
Aug. 28 – No class – Complete Lab 2		Lab 2 – Extend Lab 1 based on Bali Model
Week 4 – Exploring and Extending Models		
Aug. 31 – The Fire Model	Wilensky and Rand, Ch. 3	Sample Model: Fire
Sept. 2 – The Segregation Model	“	Sample Model: Segregation
Sept. 4 – No class – Complete Lab 3	“	Lab 3 – Explore and extend El Farol Model
Week 5 – ABM Case Studies II		
Sept. 7 – No class – Labor Day Holiday		
Sept. 9 – Sahelian Household Sustainability	West 2009	Quiz 1
Sept. 11 – Student ABM presentations I	n/a	Classic ABMS – 2 students present
Week 6 – Creating Agent-based Models		
Sept. 14 – Agent Behaviors	Wilensky and Rand, Ch. 4	Mid-term handout
Sept. 16 – Examining Models	“	Sample Model: Wolf-Sheep Predation
Sept. 18 – No class – Complete Lab 4	“	Lab 4 – Explore and Extend Wolf-Sheep
Week 7 – <i>Cultivating Knowledge I</i> (Flachs, 2019)		
Sept. 21 – Introduction	Flachs, Ch. 1	
Sept. 23 – Political Ecology	Flachs, Ch. 2	
Sept. 25 – Cotton	Flachs, Ch. 3	
Week 8 – <i>Cultivating Knowledge II</i> (Flachs, 2019)		
Sept. 28 – False Choices	Flachs, Ch. 4	
Sept. 30 – Modeling Telangana	“	
Oct. 2 – Mid-term exam	--	Mid-term exam
Week 9 – <i>Cultivating Knowledge III</i> (Flachs, 2019)		
Oct. 5 – Conclusion	Flachs, Ch. 7	
Oct. 7 – Discuss mid-term	“	
Oct. 9 – Student ABM presentations I	n/a	Classic ABMS – 2 students present
Week 10 – Components of ABM		
Oct. 12 – No class – University Day		
Oct. 14 – Collections of agents	Wilensky and Rand, Ch. 5	ABM Final Project handout
Oct. 16 – Environments	“	
Week 11 – Analyzing ABMs		
Oct. 19 – Measurements	Wilensky and Rand, Ch. 6	
Oct. 21 – Environmental data and ABM	“	Sample Model: Spread of Disease
Oct. 23 – No class – Complete Lab 5	“	Lab 5 – Produce Charts - Spread of Disease
Week 12 – ABM Verification, Validation and Replication		
Oct. 26 – Verification and validation	Wilensky and Rand, Ch. 7	Sign up for presentations
Oct. 28 – Replication	“	Demo: Model replication
Oct. 30 – No class – Complete Lab 6	“	Lab 6 – Experiments and BehaviorSpace
Week 13 – ABM Advanced topics		
Nov. 2 – NetLogo HubNet	Wilensky and Rand, Ch. 7	
Nov. 4 – NetLogo and GIS	“	Quiz 2
Nov. 6 – Workshop ABMs	--	

Week 14 – Student presentations I		
Nov. 9 – Student presentations	None	Student presentations; preview Final
Nov. 11 – Student presentations	None	Student presentations
Nov. 13 – Student presentations	None	Student presentations
Week 15 – Student presentations II		
Nov. 16 – Student presentations	None	Last day of class
Final EXAM	Final Exam (TBA)	

CLASSIC ABMS*

Axtell, Robert L., Joshua M. Epstein, Jeffrey S. Dean, . . . 2002. Population Growth and Collapse in a Multiagent Model of the Kayenta Anasazi in Long House Valley. *Proceedings of the National Academy of Sciences* 99(Suppl. 3): 7275-7279.

Model: “Artificial Anasazi” – Available in NetLogo Library and “Artificial Long House Valley” -- CoMSES Library

Agar, Michael. 2001. Another Complex Step: A Model of Heroin Experimentation. *Field Methods* 13(4): 353-369.

Model: “Drugtalk” – Available at: NetLogo User Community Models (probably requires tweaking - old NetLogo model).

Ziegler, Rolf. 2008. What Makes the Kula Go Round?: A Simulation Model of . . . *Social Networks* 30(2): 107126.

Model: “A Replication of Rolf Zieglers Kula Ring Simulation” – Available at CoMSES Library

Moritz, Mark Abigail Buffington, Andrew Yoak, Ian M. Hamilton, Rebecca Garabed. 2017. No Magic Number: An Examination of the Herd-size Threshold in Pastoral Systems using Agent-based Modeling. *Human Ecology* 45(4): 525-532.

Model: “Family Herd Demography” – Available at CoMSES Library

Foley, R. 1985. Optimality Theory in Anthropology. *Man* 20(2): 222-242.

Model: “Diet Breadth” – Available at NetLogo User Community Models

*Note: There are many, many, many more . . . search on NetLogo and CoMSES