

****Disclaimer**** This syllabus is to be used as a guideline only. The information provided is a summary of topics to be covered in the class. Information contained in this document such as assignments, grading scales, due dates, office hours, required books and materials may be from a previous semester and are subject to change. Please refer to your instructor for the most recent version of the syllabus.

SOS220: Systems Thinking

Spring 2018, Serving Sections 16767 and 25856

Tuesdays and Thursdays, 12:15pm – 1:30pm, 3 Credit Hours

COOR Hall, Rm. 120, Tempe Campus

Prerequisites: PUP 190 (or SOS 111) and SOS 110 with C or better

Faculty

Name: Dr. Andrew Bernier

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Email address: srajag20@asu.edu

Office hours: TBD

“Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing ‘patterns of change’ rather than static ‘snapshots’.” ~ Peter Senge

Catalog Description

Introduces systems thinking and complexity science, with an emphasis on analytical relevance for thinking about a myriad of issues involved in sustainability. Hones students' abilities to read and analyze critically, articulate their views clearly, and think about the many systems that shape their lives.

Course Overview

When it comes to sustainability, we find that most, if not all, of the complex challenges and solutions are made up of many parts with unique relationships between them. Many of the analytical and policy challenges related to sustainability involve systems - production, distribution and consumption systems, urban systems, cultural systems, military systems, hydrological systems, ecological systems - and their interrelations with one another. It is through systems that human beings interact with each other and the natural world. To think about sustainability clearly and devise effective solutions to triple

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bottom line predicaments confronting societies requires one to engage in “systems thinking.”

“System” refers to an “integrated whole” constituted of several interacting units, which could be parts, actors or elements. The concept of an “integrated whole” can also be stated in terms of a set of relationships among the system’s constituent units, which are differentiated from their relationships with other internal units or even units outside the system. With that, the existence of a system presupposes the presence of a boundary delineating what units are inside the system and which are not. Most systems share common characteristics, including:

- Structure, defined by components and their composition;
- Behavior, which involves processing inputs and generating outputs of material, energy, information, or data;
- Interconnectivity: the various parts of a system have functional as well as structural relationships among one another; and
- Functionality: a system may have one or several functions.

The complexity of many social systems and the natural systems they are entangled with, as well as the complexity of the entanglements themselves, makes it difficult to achieve intended outcomes and often gives rise to outcomes that were not intended or even foreseen. This course is an introductory one that examines systems structure and behavior, then what gives rise to complexity in systems, and then how we can achieve resilience in social-ecological systems. We have all heard people talk about ecosystems and social systems. In this course, we are interested in coupled or linked social-ecological systems. What impacts one part of the system, reverberates through the entirety. There are two broad objectives for this course:

1. To provide students with an understanding of the “big ideas” regarding systems thinking, complexity, and resilience; and
2. To provide students with an understanding of some of the methods and tools of analysis.

Basically, the aim is for you to “see systems, read systems, change systems”. To facilitate achieving these broad objectives, students will have a variety of tasks to secure this knowledge. The assignments in this class will work on improving our abilities to this effect.

Learning Outcomes

At the completion of this course, students will be able to:

1. Explain the structure, behavior, and functionality of systems (e.g., water, energy, cities, and ecosystems) including the characteristics and interconnections among environmental, social, and economic sub-systems.
2. Discuss features of systems complexity, including diversity, redundancy, tipping points/thresholds, non-linearity, externalities, resilience, vulnerability, emergence,

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agency; and explain their relevance for sustainability.

3. Define physical, social, and symbolic/analytical system boundaries and explain different ways of bounding problems and systems for sustainability problem-solving (problem framing) across multiple scales.
4. Critically reflect on one's own ways of systems thinking in the context of different ways of acquiring knowledge as well as knowing, including different scientific methods and discipline as well as traditional knowledge systems.

Course Topics, Schedule & Grading

Activities used for instruction and assessment of learning include: discussion/presentations; textbook and supplemental readings; systems mapping and diagramming; individual and group activities/assignments; and case scenarios.

Required Texts for the Course: These books will be actively referred to during the course. Readings and assignments will be directly associated with these texts.

1. Meadows, Donella. (2008) *Thinking in systems: A primer*. Edited by Dianne Wright. White River Junction, VT: Chelsea Green Publishing.
2. Walker, Brian, and David Salt. (2006) *Resilience thinking: sustaining ecosystems and people in a changing world*. Washington, D.C.: Island Press
3. Mitchell, Melanie. (2009) *Complexity: a guided tour*. Oxford University Press, 2009.
4. Cabrera, Derek & Cabrera, Laura. (2015) *Systems Thinking Made Simple: New Hope for Solving Wicked Problems*. Odyssean Press. 1st Edition.
5. Systems Thinking Group (2016) *Habits of a Systems Thinker* (Mobile Application). The Waters Foundation. Available on Google Play and the App Store.

Recommended Texts for the Course: These books are just a few of the seminal works in the field of systems thinking. They will be referred to in talks and are highly encouraged to be cited in student work, but are not absolutely required for basic course success.

1. Barabasi, Albert Laszlo. (2014) *Linked*. New York. NY: Basic Books
2. Caldarelli, Guido & Catanzaro, Michele. (2012) *Networks: A very short introduction*. New York, NY. Oxford University Press.
3. Capra, Fritjof. (2002). *The hidden connections: A science for sustainable living*. New York, NY: Anchor.
4. Holland, John. (2014) *Complexity: A very short introduction*. New York, NY. Oxford University Press.
5. Senge, Peter. (1990) *The Fifth Discipline: The Art & Practice of the Learning Organization*. New York, NY. Crown Business.
6. Various articles and websites made available on Blackboard course

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Possible Schedule of Topics, Activities and Assignments	Points	Discussion Dates
Course Introduction: Intros, Syllabus, Interest Map		1/9
Area 1: Fundamentals of Systems Thinking, Intro to Resilience and Complexity		
Fundamentals of Systems Thinking Read: Meadows Introduction, pages 1-7 Work: Introduction to Campus Systems Digital Map		1/11
Introduction to Resilience Read: Walker and Salt Chapter 1		1/16
Introduction to Complexity Read: Mitchell Chapter 1 DUE: Partner, "Working" Outline of Campus Systems Digital Map	25	1/18
Area 1 Forum Reply	25	Due 1/19
Area 2: Problems and Root Causes, System Rules, Dynamics and Chaos Theory		
Defining Problems and Root Causes Read: Cabrera and Cabrera Chapter 1 Work: Systems Analysis Paper Introduction		1/23 Bernier OUT Sushil Lead
System Rules Read: Walker and Salt Chapter 2, Review C & C Ch. 3 Work: Campus Digital Map		1/25 Bernier OUT No class Meeting
Dynamics and Chaos Theory (Shortened) Read: Mitchell Chapter 2		1/30
Area 2 Forum Reply	25	Due 1/31
Area 3: Systems Conceptualization, Thresholds, Language of Systems		
Systems Conceptualization Read: Meadows Chapter 1, pages 11-17 DUE: Systems Analysis Paper Outline		2/1 2 Leads
System Thresholds Read: Walker and Salt Chapter 3		2/6 2 Leads
The Language of Systems Read: Meadows Chapter 1 pg. 17-35		2/8 2 Leads
Area 3 Forum Reply	25	Due 2/9
Area 4: Visualizing Information, Information in Complexity, Adaptive Cycle		
Visualize Information and Structure	50	2/13 2 Leads

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Read: Cabrera & Cabrera, Chapter 4 DUE: 1 st Complete Campus Systems Digital Map		
The Role of Information in Complexity Read: Mitchell Chapter 3		2/15 2 Leads
The Adaptive Cycle Read: Walker and Salt Chapter 4 DUE: Systems Analysis Paper 1 st Draft		2/20 2 Leads
Area 4 Forum Reply	25	Due 2/21
Area 5: The Systems Zoo, Application of Resilience Thinking		
<i>The Systems Zoo Part I- One Stock Systems</i> Read: Meadows Chapter 2, pages 35-58 Work: (Possible Consolidate w/ 3/1)		2/22 2 Leads
Application of Resilience Thinking Read: Walker and Salt Chapter 5		2/27 2 Leads
<i>The Systems Zoo Part II- Two Stock Systems</i> Read: Meadows Chapter 2, pages 58-72 Work: Systems Analysis Paper Work (If time allows)		3/1 2 Leads
Area 5 Forum Reply	25	Due 3/2
Systems Analysis Paper FINAL	150	Due 3/2
Area 6: Evolution and Complexity, Measuring Complexity, Systems Zoo Practice		
Evolution and Complexity (Shortened or consolidated w/ 3/15) Read: Mitchell Chapter 5		3/13 2 Leads
Measuring Complexity Read: Mitchell Chapter 7		3/15 2 Leads
Make Structural Predictions Read: Cabrera & Cabrera, Chapter 6		3/20 2 Leads
Area 6 Forum Reply	25	Due 3/21
Area 7: Science of Networks, Systems Thinking Scaling		
The Science of Networks Read: Mitchell Chapters 15, 16		3/22 2 Leads
Scaling Systems Thinking Read: Cabrera & Cabrera, Chapter 9		3/27 2 Leads

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The Mysteries of Scaling Read: Mitchell Chapter 17 DUE: Revisited and Updated Campus Systems Digital Map	75	3/29 2 Leads
Area 7 Forum Reply	25	Due 3/29
Area 8: Systems and Us, Traps and Opportunities		
Systems and Us (Part 1) Read: Meadows Chapters 3 and 4 (end of p.94) Work: Introduction of Book/Issue Mapping Project		4/3 2 Leads
Systems and Us (Part 2) Read: Meadows Rest of Chapter 4		4/5 2 Leads
System Traps and Opportunities Read: Meadows Chapter 5 DUE: Initial Book Map In-Progress Sketch In Blackboard		4/10 2 Leads
Area 8 Forum Reply	25	Due 4/11
Area 9: Change in Systems and Resilience in Sustainability		
Creating Change on Systems and Our Philosophy (Part 1) Read: Meadows Chapter 6		4/12
Resilience and Sustainability Read: Walker and Salt Chapter 6		4/17
Creating Change on Systems and Our Philosophy (Part 2) Read: Meadows Chapter 7		4/19
Area 9 Forum Reply	25	4/20
Area 10: Course Emergence for Today and The Future		
Systems Thinking of 7.6 Selves Read: Cabrera and Cabrera, Chapter 10		4/24
ST in Learning Organizations and the Circular Economy Read: Cabrera and Cabrera, Chapter		4/26
Area 10 Forum Reply	25	4/27
Book Mapping Project FINAL	150	DUE 4/27
Final Exam Open FINAL Book/Issue Map (Student Created)	200	Thursday 5/1 12:10pm – 2:00pm

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Course Requirements

Assignments	Grading
10 Blackboard Forum Topic Assignments	250 points
In-class Discussion Lead	100 points
A Campus Systems Digital Map	150 points
Systems Story Analysis Paper	150 points
Book/Issue Mapping Project	150 points
Final Exam	200 points
Total	1000 points

Blackboard Discussion Forum Participation

Accompanying each area above will be a discussion forum. Students will be required to engage in the discussion forum for each topic on Blackboard. This will often be in the form of short responses that weave together some of the basic questions or activities posed by the readings. While each class session will pose a separate question, it is on the student to weave together a reply that creatively answers all questions. So, not just a “question: answer” format, but a thoughtful yet succinct response.

In-class Discussion Leads: Readings meet SDG Relevancy

Two students will be assigned as Discussion Leads for each assigned reading starting with Area 3. The Discussion Leads will lead class discussion, introducing the readings, provide a super brief summary while including challenges and processing of the reading. To complement the reading, each lead will choose a separate SDG of interest. The duo will then identify a relationship between the two SDGs and initiate discussion of how the readings may affect this relationship. The leads should propose 3-5 questions to the class to initiate discussion. They could animate the discussion by calling on fellow students to comment and making sure everyone has an opportunity to speak. If the discussion sags, make provocative comments. You may use PowerPoint, Prezi or drawn visuals but this is not required. (The two students assigned as Discussion leads for a reading should meet before the class to coordinate.) The Instructor will assign a grade to each Discussion leader based on how well they prepared and how successful they were in stoking an animated discussion among peers.

Systems Story Paper – DUE 3/2 at 11:59 PM

Students will write a 10-page paper serving three purposes:

- 1) analyzes an aspect of climate change and its impacts and effects on society,
- 2) attempts to take a traditional linear academic paper and incorporate systems elements into its structure,

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3) presents the topic in a narrative structure while rooted in research review

It will examine climate change as a social-ecological system and incorporate the knowledge that we are acquiring in class. The report may cover it from the perspective of specific groups of people, take a regional/national/international perspective, focus on specific effects, focus on adaptation efforts, etc. There is a great deal of flexibility from this perspective. This is an analysis, so critical thought is expected with cogent and coherent arguments, and personal insights only when building upon evidence collected through literature review and research.

And as opposed to writing a traditional academic paper which itself is a linear construct, students will be challenged to exercise creativity and risk to make a paper a system itself by incorporating system dynamics. There is no right or wrong way to do this, but rather students will be assessed on how intentional they are as describing what they are attempting in the paper structure, all the while describing the climate change issue at hand. It may be wise to allow the structure of the issue being discussed to inform and guide how the structure of the paper goes. This is a very abstract concept, but so was the theory of systems when it was first introduced.

A rubric will help you to understand the points from how the papers will be assessed.

A Campus Systems Digital Map – 1st DUE 2/23, 2nd Revised DUE 3/29 at 11:59 PM

Students will construct an on-going digital mapping project of an operational system on ASU Tempe's campus. In TEAMS of 2, students will select a systems mapping software/platform (or will be assigned one) under "Resources" in Blackboard to construct a systems map. In your digital map, please include the following:

- Conduct potential recorded interviews with affected stakeholders (mix of students, staff)
- Pictures and/or video of system content and use in motion
- Geographical mapping of where system elements and links are located on campus
- Labeling with brief explanation of systems concept discussed manifesting on campus

Students will first submit a working outline of their systems map (25 pts). Then, students will complete a first final product with what they have learned so far (50 pts). Students will then add to and make more robust the same map as the semester progresses for a second and larger grade (75pts). Potential operational systems on campus include transportation, waste, food, solar, bicycles, residential, healthcare, trees, safety, etc.

A rubric will help you to understand the points from how the papers will be assessed.

The Book/Issue Mapping Project – DUE 4/27 at 11:59 PM

Students will select a systems mapping software/platform (or will be assigned one) to construct an INDIVIDUAL systems map of the two topics:

- 1) maps out the common and unique concepts covered in the required course books (Meadows, Mitchell, Walker & Salt, Cabrera & Cabrera),

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2) connect those concepts with their Sustainable Development Goal of choice.

This is not a paper, but rather a detailed digital visual map that first maps the ideas and concepts discussed in the required books. As you read, some concepts will overlap, and some will be unique to each author. Your map will show and discuss how the different concepts affect one another in the fields of systems thinking, complexity and resilience.

Once you have done so, you will then complement the structure of the book maps with an SDG (either the one you individually chose for your Discussion Lead or a new one). It is on you to quickly explain how each systems thinking idea emerges in your SDG of interest. That way, your map has systems language explicitly marked while anchored in a real world equivalent that matters to you. The time, depth and detail you put into this will matter, as the final product you create will be the only aid you are allowed during the final exam. So, your effort on this may generously help you for your final exam.

A rubric will help you to understand the points from how the maps will be assessed.

Grading

Grade	Percentage Points	Range
A	90 – 100%	900 – 1000
B	80 – 89%	800 – 899
C	70 – 79%	700 – 799
D	60 – 69%	600 – 699
E/F	Below 60%	600 and below

Grading Procedure

Grades reflect your performance on assignments and adherence to deadlines. Graded assignments will be available within one week of the due date via the Gradebook.

Online Digital Classroom

In addition to our in-person meetings, there will be a digital representation of our course on Blackboard. In an attempt to be as paper-free as possible, most of our assignments and submissions will be facilitated through this digital space. I will also be using this space to post articles, presentations, websites, rubrics, notes, etc. You can log into Blackboard and the course via MyASU or <https://my.asu.edu>.

Communicating with the Instructor

This course uses a discussion board in Blackboard called "Hallway Conversations" for general questions about the course. Prior to posting a question, check the syllabus, announcements, and existing posts. If you do not find an answer, post your question. You are encouraged to respond to the questions of your classmates. Email questions of a personal nature to the instructor. You can expect a response within 48 hours.

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Email and Internet

ASU email is an official means of communication among students, faculty, and staff. Students are expected to read and act upon email in a timely fashion. Students bear the responsibility of missed messages and should check their ASU-assigned email regularly. All instructor correspondence will be sent to your ASU email account.

Course Time Commitment

This three-credit course requires approximately 135 hours of work. Please expect to spend around 15-18 hours each week preparing for and actively participating in this course.

Late or Missed Assignments

Notify the instructor BEFORE an assignment is due if an urgent situation arises and the assignment will not be submitted on time. Published assignment due dates (Arizona Mountain Standard time) are firm. Please follow the appropriate University policies to request an accommodation for religious practices or to accommodate a missed assignment due to University-sanctioned activities.

Submitting Assignments

All assignments, unless otherwise announced, MUST be submitted to the designated area of Blackboard. Do not submit an assignment via email.

Drop and Add Dates/Withdrawals

This course adheres to a compressed schedule and may be part of a sequenced program, therefore, there is a limited timeline to drop or add the course. Consult with your advisor and notify your instructor to add or drop this course. If you are considering a withdrawal, review the following ASU policies: Withdrawal from Classes, Medical/Compassionate Withdrawal, and a Grade of Incomplete.

Grade Appeals

Grade disputes must first be addressed by discussing the situation with the instructor. If the dispute is not resolved with the instructor, the student may appeal to the department chair per the University Policy for Student Appeal Procedures on Grades.

Student Conduct and Academic Integrity

Academic honesty is expected of all students in all examinations, papers, laboratory work, academic transactions and records. The possible sanctions include, but are not limited to, appropriate grade penalties, course failure (indicated on the transcript as a grade of E), course failure due to academic dishonesty (indicated on the transcript as a grade of XE), loss of registration privileges, disqualification and dismissal. For more information, see <http://provost.asu.edu/academicintegrity>. Additionally, required behavior standards are listed in the Student Code of Conduct and Student Disciplinary Procedures, Computer, Internet, and Electronic Communications policy, and outlined by

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the Office of Student Rights & Responsibilities. Anyone in violation of these policies is subject to sanctions. Students are entitled to receive instruction free from interference by other members of the class. An instructor may withdraw a student from the course when the student's behavior disrupts the educational process per Instructor Withdrawal of a Student for Disruptive Classroom Behavior. Appropriate online behavior (also known as netiquette) is defined by the instructor and includes keeping course discussion posts focused on the assigned topics. Students must maintain a cordial atmosphere and use tact in expressing differences of opinion. Inappropriate discussion board posts may be deleted by the instructor. The Office of Student Rights and Responsibilities accepts incident reports from students, faculty, staff, or other persons who believe that a student or a student organization may have violated the Student Code of Conduct.

Prohibition of Commercial Note Taking Services

In accordance with ACD 304-06 Commercial Note Taking Services, written permission must be secured from the official instructor of the class in order to sell the instructor's oral communication in the form of notes. Notes must have the notetaker's name as well as the instructor's name, the course number, and the date.

Course Evaluation

Students are expected to complete the course evaluation. The feedback provides valuable information to the instructor and the college and is used to improve student learning. Students are notified when the online evaluation form is available.

Syllabus Disclaimer

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. Please remember to check your ASU email and the course site often.

Accessibility Statement

In compliance with the Rehabilitation Act of 1973, Section 504, and the Americans with Disabilities Act as amended (ADAAA) of 2008, professional disability specialists and support staff at the Disability Resource Center (DRC) facilitate a comprehensive range of academic support services and accommodations for qualified students with disabilities. Qualified students with disabilities may be eligible to receive academic support services and accommodations. Eligibility is based on qualifying disability documentation and assessment of individual need. Students who believe they have a current and essential need for disability accommodations are responsible for requesting accommodations and providing qualifying documentation to the DRC. Every effort is made to provide reasonable accommodations for qualified students with disabilities. Qualified students who wish to request an accommodation for a disability should contact the DRC by going to <https://eoss.asu.edu/drc>, calling (480) 965-1234 or emailing

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DRC@asu.edu. To speak with a specific office, please use the following information:

ASU Online and Downtown Phoenix Campus University Center Building, Suite
160 602-496-4321 (Voice)

Polytechnic Campus 480-727-1165 (Voice)

West Campus University Center Building (UCB), Room 130 602-543-8145
(Voice)

Tempe Campus 480-965-1234 (Voice)

Title IX Statement

Title IX of the Education Amendments of 1972 protects individuals from discrimination based on sex in any educational program or activity operated by recipients of federal financial assistance. Sexual harassment, which includes acts of sexual violence, is a form of sex discrimination prohibited by Title IX. ASU does not discriminate on the basis of sex in the employment, education programs or activities it operates. Please visit www.asu.edu/titleIX/ for more information or to file a complaint.

Computer Requirements

This course requires a computer with Internet access and the following:

- [Web browsers \(Chrome, Internet Explorer, Mozilla Firefox, or Safari\)](#)
- [Adobe Acrobat Reader \(free\)](#)
- [Adobe Flash Player \(free\)](#)
- Microphone (optional) and speaker

Technical Support

This course uses Blackboard to deliver content. It can be accessed through MyASU at <http://my.asu.edu> or the Blackboard home page at <https://myasucourses.asu.edu> To monitor the status of campus networks and services, visit the System Health Portal at <http://syshealth.asu.edu/>. To contact the help desk call toll-free at 1-855-278-5080.

Student Success

This is not an easy course. To be successful:

- attend each in-person class session
- check the Blackboard classroom daily
- read any announcements
- read and respond to course email messages as needed
- complete assignments by the due dates specified
- communicate regularly with your instructor and peers
- create a study and/or assignment schedule to stay on track