

GGOV 622 COMPLEXITY AND GLOBAL GOVERNANCE

University of Waterloo

Global Governance

Winter 2023

Time: Thursdays, 10:00 am – 12:50 pm

Location: BSIA 1-32 (67 Erb St. W.)

Instructor: Michael Lawrence, PhD

Email: m8lawren@uwaterloo.ca

Office Hours: Thursdays, 1:30 – 2:30 pm, BSIA 316

The University of Waterloo resides on the Haldimand Tract, the land promised to the Six Nations that includes six miles on each side of the Grand River, within the traditional territory of the Neutral, Anishinaabe, and Haudenosaunee peoples.

Course Overview:

To say that global governance is immensely *complex* is something of a truism, but it need not be an empty one. Advances in complexity science yield crucial insights about global systems by elucidating *the nature* of their complexity. This fast-growing literature reveals common structures and behaviours among systems across academic fields, from physics to ecology to sociology. It yields significant and novel contributions to the methodology, theory, and practice of global governance.

Methodologically, complexity explores dense networks of causation in ways that highlight non-linearities and feedbacks. Important tools include system and network mapping, energy accounting, and agent-based modelling. Theoretically, complexity science provides new perspectives on the ontology of social systems and the evolution of human civilization. It applies a range of keystone concepts, such as emergence, critical transitions, and adaptation. Practically, the complexity literature helps to build resilient social systems, make effective policy under conditions of uncertainty, respond to cascading crises, and think critically about societal (un-) sustainability.

After introducing key concepts, theories, and tools from complexity science, this seminar explores its most recent empirical findings in several global governance domains, including environment, political economy, and security. Students will assess the value-added and policy implications of the complexity approach while developing their own research projects.

The field of global governance aspires to transcend the obsolete strictures of International Relations in order to better address the challenges facing humanity in the 21st century. Complexity science provides essential foundations for this endeavour by moving beyond the Newtonian paradigms of old. This seminar will ultimately equip participants to realize these forward-looking transformations.

Weekly Seminar Themes:

Week 1: Jan. 12 – Introduction to complex systems thinking

Week 2: Jan. 19 – Complexity, connectivity, and causality

Week 3: Jan. 26 – Energy in human civilization

Week 4: Feb. 2 – Complex social systems: worldviews, institutions, technologies

Week 5: Feb. 9 – Adaptation, resilience, and critical transitions

Week 6: Feb. 16 – Global networks

Reading Week: Feb. 18-26 – No Class

Week 7: Mar. 2 – Global systemic risk

Week 8: Mar. 9 – Societal collapse

Week 9: Mar. 16 – Complexity, world order, and global governance

Week 10: Mar. 23 – Complexity in policy and practice

Week 11: Mar. 30 – Student presentations

Week 12: Apr. 6 – Student presentations

COVID-19 Contingency Plans:

This seminar is an in-person class. Should a resurgence of COVID-19 disrupt the University's ability to hold in-person classes, we will shift to an online format (via Zoom) and adjust the format of the course as necessary.

Evaluation:

Participation	20%
Systems Map (due Feb. 16 before class)	20%
Thematic Analysis (due Mar. 16 before class)	20%
Research presentation (Mar. 30 or Apr. 6)	10%
Final essay (due Apr. 21 by midnight EST)	30%

Participation (20%): You are expected to attend every class unless you have a valid reason to be absent of which you have informed the instructor. You are also expected to actively participate in seminar discussions. Your participation will be evaluated based on the quality, not the quantity, of your contribution. Good contributions build upon ideas raised by your peers, provide helpful examples, advance the discussion, encourage others to participate, and maintain an open and respectful environment. You are welcome to pursue your questions and ideas further on the discussion boards of the class Learn site (especially if you did not have a chance to raise them during class).

Systems Map (20%): You will produce a causal loop diagram (as explained in Week 2) of an issue in world politics. (You may take this as an opportunity to develop a systemic understanding of your final paper topic). Your map should incorporate 10-15 causal factors and the positive and negative relationships between them. Accompany your map with a text of approximately 2400 words (give or take ten percent) divided into the following sections:

- 1) *Explanation:* in no more than 1000 words, provide an overview of your system by explaining the causal relationships it depicts. Provide empirical support for these connections, especially the most important and less obvious ones.
- 2) *Analysis:* in approximately 1000 words, identify the positive and/or negative feedback loops in your systems map and explain how they generate important system behaviours. Which causal relationships tend to resist change? What possible intervention points does your map suggest for systemic change? And what complex systems behaviours (e.g. emergence, self-organization, path-dependence, non-linear change, etc.) does this system exhibit?
- 3) *Methodological Evaluation:* in approximately 400 words, evaluate the strengths and weaknesses of the system mapping exercise. What surprised you most as you drew your map? What aspects of the issue does this technique fail to capture?

This assignment is due before class on February 16 via the dropbox on the course Learn site. You may use whichever reference style you prefer.

Thematic Analysis (20%): In 1800-2200 words, analyze the key themes from **one** of our sessions from weeks 2 to 8. You should provide your own unique perspective on the class discussion, the weekly readings, and at least one of the further readings listed for the week. You may take this as an opportunity to explore in depth the complexity concepts you wish to apply in your final paper. Your analysis should perform the following tasks:

- Provide clear definitions of the key concepts involved in this theme and explain how they relate to one another.
- Compare and contrast different authors' treatment of these concepts, or their respective contributions to the general theme of the week.
- Explain how this course theme applies to the study of global governance/world politics. What sorts of unique insights can it provide? What are its weaknesses and shortcomings? (Short, quick examples would be helpful here).

Your assignment should be in essay style and include appropriate references in the format of your choosing. You will be evaluated for your writing style, your knowledge of the course theme, and the insights you provide on its application to world politics. This assignment is due before class on Mar. 16 via the dropbox on the course Learn site but may be submitted at any time before then.

Research Presentation (10%): Early in the course (date TBD), you will present to the class the research topic of your final paper and the complexity approach you wish to apply as part of your participation grade. You will present a preliminary version of your research to the class on either March 30 or April 6. The length of your presentation will depend on class size (TBD). Your talk should spur class discussion, which you will facilitate. This exercise represents an opportunity to solicit ideas and feedback from your peers as you draft your final paper.

Final Essay (30%): Your final essay should be approximately 4000 words, give or take ten percent (at least 3600 words and no more than 4400 words). Formatting and reference style are up to you. Your final essay should apply a complex systems lens to an issue of global governance/world politics, broadly defined. Due on Friday, April 21 by midnight EST via the dropbox folder on the course Learn site.

As an alternative to the final essay assignment, you may participate in the Waterloo Institute for Social Innovation and Resilience (WISER)'s Winter Transdisciplinary Social Innovation Lab: <https://uwaterloo.ca/waterloo-institute-for-social-innovation-and-resilience/projects/transdisciplinary-systemic-innovation-lab-wisir>. You will still have to submit a final report on the experience that demonstrates your knowledge of course themes, and make a presentation to the class about the process.

Late Policy: Late assignments will be penalized 2% per day, including weekends. Extensions will only be granted in cases of a valid and verified justification.

Complex Systems Resources:

Oxford Bibliography on Complex Systems Approaches to Global Politics (compiled by Scott Janzwood and Jinelle Piereder): <https://www.oxfordbibliographies.com/view/document/obo-9780199743292/obo-9780199743292-0278.xml>.

Waterloo Institute of Complexity and Innovation at the University of Waterloo (<https://uwaterloo.ca/complexity-innovation/>).

- Complexity Reading List: https://uwaterloo.ca/complexity-innovation/sites/ca.complexity-innovation/files/uploads/files/complexity-reading-list_feb2013.pdf.

Waterloo Institute for Social Innovation and Resilience at the University of Waterloo (<https://uwaterloo.ca/waterloo-institute-for-social-innovation-and-resilience/>).

- Learning modules on social innovation for complex problems: <https://uwaterloo.ca/waterloo-institute-for-social-innovation-and-resilience/learning-modules>.

Cascade Institute at Royal Roads University (cascadeinstitute.org).

- Interactive map of individuals and organizations engaged in the study of complex systems around the world: <https://cascadeinstitute.org/resources/map/>.
- Narrated slideshows on complexity themes as part of the Complexity Education for Action project: <https://cascadeinstitute.org/research/complexity-education-for-action/>.

Map the System at the University of Oxford, Saïd Business School, and Skoll Centre for Social Entrepreneurship (<https://mapthesystem.sbs.ox.ac.uk/home>).

- Map the System Canada: <https://www.mapthesystem.ca/>.
- Anna Johnson, Daniela Papi-Thornton, and James Stauch (2019). *Student Guide to Mapping a System*: <https://www.mapthesystem.ca/s/Student-Guide-to-Mapping-a-System.pdf>.

Santa Fe Institute (www.santafe.edu).

Center for the Study of Complex Systems at the University of Michigan (www.lsa.umich.edu/cscs/).

Systems Innovation video courses (www.youtube.com/c/ComplexityLearningLab/playlists).

University Policies:

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo are expected to promote honesty, trust, fairness, respect and responsibility. Check the [Office of Academic Integrity webpage](#) for more information.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offences, and to take responsibility for their actions. Check [the Office of Academic Integrity](#) for more information. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to [Policy 71 - Student Discipline](#). For typical penalties check [Guidelines for the Assessment of Penalties](#).

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read [Policy 70 - Student Petitions and Grievances](#), Section 4. When in doubt, please be certain to contact the department’s administrative assistant who will provide further assistance.

Appeals: A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 - Student Discipline may be appealed if there is a ground. A student who believes they have a ground for an appeal should refer to [Policy 72 - Student Appeals](#).

Note for Students with Disabilities: The [AccessAbility Services](#) office, located on the first floor of the Needles Hall extension (NH 1401), collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AS office at the beginning of each academic term.

Weekly Seminar Schedule:

Note that all readings are available through the course Learn site and the University of Waterloo library, with one exception that you must acquire for week 6:

- Guido Caldarelli and Michele Catanzaro (2012). *Networks: A Very Short Introduction*. Oxford: Oxford University Press.

Week 1: Jan. 12 – Introduction to complex systems thinking

After a brief overview of the course, we will delve right into different definitions and measurements of complexity. We will consider the distinctive features of the complex systems perspective and introduce some key concepts from the complexity literature. Finally, we will discuss three questions: is the world getting more complex? How do we know? And what does that mean for global governance and world politics?

Readings:

- Melanie Mitchell (2009). “Preface” and “What is Complexity?” Chapter 1 of *Complexity: A Guided Tour* (Oxford and New York: Oxford University Press), pp. ix-xiii, 3-14.
- Thomas Homer-Dixon (2011). “Complexity Science,” *Oxford Leadership Journal*, vol. 2, no. 1: pp. 1-15. <https://homerdixon.com/wp-content/uploads/2017/05/Homer-Dixon-Oxford-Leadership-Journal-Manion-lecture.pdf>.
- Murray Gell-Mann (1997). “The Simple and the Complex,” in *Complexity, Global Politics, and National Security*, edited by David Alberts and Thomas Czerwinski (Washington, D.C.: National Defense University, 1997), pp. 3-28.

Further Reading:

- Melanie Mitchell (2009). *Complexity: A Guided Tour*. Oxford and New York: Oxford University Press. See especially Chapter 7, “Defining and Measuring Complexity,” pp. 94-111.
- Seth Lloyd (2001). “Measures of Complexity: A Non-Exhaustive List,” <https://web.mit.edu/esd.83/www/notebook/Complexity.PDF>.
- M. Mitchell Waldrop (1992). *Complexity: The Emerging Science at the Edge of Order and Chaos*. New York: Touchstone Books.
- James Crutchfield, J. Dooyne Farmer, and Norman Packard (1986). “Chaos,” *Scientific American*, vol. 255, no. 6: pp. 46-57.
- Ludwig von Bertalanffy (1950). “An Outline of General System Theory,” *The British Journal for the Philosophy of Science*, vol. 1, no. 2: pp. 134-165.
- Ludwig von Bertalanffy (1972). “The History and Status of General Systems Theory,” *The Academy of Management Journal*, vol. 15, no. 4: pp. 407–426.

Week 2: Jan. 19 – Complexity, connectivity, and causality

At the crux of the complex systems perspective is a much richer understanding of causation than found in orthodox disciplinary approaches. Complex causation involves multiple causality, interactive effects, equifinality, INUS sets, non-linear relationships, and feedback loops. Emergence, a keystone concept of complexity, features dense cycles of bottom-up and top-down causation that generate novel behaviors, social structure, and collective agency. In this session, you will learn how to read and draw causal loop diagrams (systems maps), the focus of your first assignment.

Readings:

- Robert Jervis (1997). "Complex Systems: The Role of Interactions," in *Complexity, Global Politics, and National Security*, edited by David Alberts and Thomas Czerwinski (Washington, D.C.: National Defense University, 1997), pp. 45-72.
- J. de Haan (2006). "How Emergence Arises," *Ecological Complexity*, vol. 3, no. 4: pp. 293-301.
- Dave Elder-Vass (2010). "Emergence," and excerpts from "Cause," and "Social Ontology and Social Structure," chapters 2, 3, and 4 of *The Causal Power of Social Structures: Emergence, Structure, and Agency* (Cambridge, UK, and New York: Cambridge University Press), pp. 13-43; 53-62; 66-68.

Further Reading:

- Meadows, Donella H. (2008). *Thinking in Systems: A Primer*. Edited by Diana Wright. White River Junction, VT: Chelsea Green Publishers.
- Dave Elder-Vass (2010). "Normative Institutions," and "Organisations," chapters 6 and 7 of *The Causal Power of Social Structures: Emergence, Structure, and Agency*. Cambridge, UK, and New York: Cambridge University Press, pp. 115-168.
- Keith Sawyer (2001). "Emergence in Sociology: Contemporary Philosophy of Mind and Some Implications for Sociological Theory," *American Journal of Sociology*, vol. 107, no. 3: pp. 551-85.
- Robert Jervis (2012). "System Effects Revisited," *Critical Review*, vol. 24, no. 3: pp. 393-415.
- David C. Earnest (2015). "The Gardiner and the Craftsman: Four Types of Complexity in Global Life," in Emilian Kavalski, ed., *World Politics at the Edge of Chaos: Reflections on Complexity and Global Life* (Albany, NY: State University of New York Press), pp. 31-51.
- James Mahoney, Erin Kimball, and Kendra L. Koivu, (2009). "The Logic of Historical Explanation in the Social Sciences," *Comparative Political Studies*, vol. 42: pp.114-28 on different meanings of 'causation.'

Week 3: Jan. 26 – Energy in human civilization

By the second law of thermodynamics, the universe can only increase in entropy (disorder), and yet high-quality concentrations of energy enable the growth of complex pockets of order, including ecosystems and human civilization. Energy, in this key sense, is the basic currency of order in the universe and shapes ecological and social organization alike. We will explore such relationships using concepts of energy return on investment (EROI), emergy, exergy, and energy quality, alongside their difficult implications for the transition from fossil fuels to green energy.

Readings:

- Thomas Homer-Dixon (2006). “A Keystone in Time,” chapter 2 of *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization*. Toronto: Knopf, 2006: pp. 31-55.
- Charles A. S. Hall (2017). Chapters 1, 3, 10, and 12 of *Energy Return on Investment: A Unifying Principle for Biology, Economics, and Sustainability*. Cham, Switzerland: Springer: pp. 3-6, 14-18, 21-31, 107-117, 145-169.
- Joseph Tainter et al. (2003). “Resource Transitions and Energy Gain: Contexts of Organization,” *Conservation Ecology*, vol. 7, no. 3.
<http://www.ecologyandsociety.org/vol7/iss3/art4/print.pdf>.

Further reading:

- Thomas Homer-Dixon (2006). “So Long, Cheap Slaves,” chapter 4 of *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization*. Toronto: Knopf, 2006: pp. 77-100.
- Vaclav Smil (2017). *Energy and Civilization: A History*. Cambridge, MA and London, UK: The MIT Press.
- Vaclav Smil (2022). *How the World Really Works: The Science Behind How We Got Here and Where We’re Going*. London: Viking.
- Stephen Quilley (2013). “De-Growth is not a Liberal Agenda: Relocalisation and the Limits to Low Energy Cosmopolitanism,” *Environmental Values*, vol. 22, no. 2: pp.261-285.
- Eric D. Schneider and James J. Kay (1994). “Complexity and Thermodynamics: Towards a New Ecology,” *Futures*, vol. 26, no. 6: pp. 626-647.
- Victor Court (2018). “Energy Capture, Technological Change, and Economic Growth: An Evolutionary Perspective,” *BioPhysical Economics and Resource Quality*, vol. 3, art. 12.
- Howard T. Odum (1988). “Self-Organization, Transformity, and Information,” *Science*, vol. 242, no. 4882: pp. 1132-1139.
- Erwin Schrödinger (1944). “Order, Disorder and Entropy,” chapter 6 in *What Is Life?* (Cambridge: Cambridge University Press): pp. 672–80.

Week 4: Feb. 2 – Complex social systems: worldviews, institutions, technologies

How do we even begin to contemplate the immense complexity of global social systems? In this session we start with the basics of complex adaptive systems before considering global socio-ecological systems and their constituent worldviews, institutions, and technologies (WITs). The WIT framework allows us to think about cultural evolution, as well as the role of positive feedbacks and path dependence in social systems.

Readings:

- Rachael Beddoe et al. (2009). “Overcoming Systemic Roadblocks to Sustainability: The Evolutionary Redesign of Worldviews, Institutions, and Technologies,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 106, no. 8: pp. 2483-2489.
- Paul Pierson (2004). Excerpts from “Positive Feedback and Path Dependence” and “Institutional Development,” chapters 1 and 5 in *Politics in Time: History, Institutions, and Social Analysis* (Princeton: Princeton University Press): pp. 17-30, 44-48, 133-153.
- W. Brian Arthur (2009). “Combination and Structure” and “Mechanisms of Evolution,” chapters 2 and 9 of *The Nature of Technology: What it is and How it Evolves* (New York: Free Press): pp. 27-43, 167-189.

Further Reading:

- John Holland (1992). “Complex Adaptive Systems,” *Daedalus*, vol. 121: pp. 17-30.
- W. Brian Arthur (1993). “On the Evolution of Complexity,” Santa Fe Institute Working Paper 1993-11-070 <https://www.santafe.edu/research/results/working-papers/on-the-evolution-of-complexity>.
- Oran Young et al. (2006). “The Globalization of Socio-Ecological Systems: An Agenda for Scientific Research,” *Global Environmental Change*, vol. 16: pp. 304-316.
- Geoffrey L. Herrera (2006). *Technology and International Transformation: The Railroad, the Atom Bomb, and the Politics of Technological Change*. Albany, NY: State University of New York Press.
- Douglass C. North (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge and New York: Cambridge University Press.
- Andrew Bennett and Colin Elman (2006). “Complex Causal Relations and Case Study Methods: The Example of Path Dependence,” *Political Analysis*, vol. 14, no. 3: pp. 250-267.
- Scott E. Page (2006). “Path Dependence,” *Quarterly Journal of Political Science*, vol. 1: pp. 87-115.
- John H. Holland (2014). *Complexity: A Very Short Introduction*. Oxford: Oxford University Press.

Week 5: Feb. 9 – Adaptation, resilience, and critical transitions

In this session, we will apply insights from the ecology literature to issues of global governance. The *adaptive cycle* and *panarchy theory* highlight the interplay of stability and change, accumulation and breakdown, as normal phases of system development. *Resilience* is now a popular buzzword, but the concept has been rigorously theorized in relation to *stability landscapes* and can be applied in practical ways. As systems slowly lose their resilience over time, incremental changes may generate drastic *critical transitions* involving multiple equilibria, threshold change, hysteresis, and limited reversibility.

Readings:

- C. S. Holling (2001). "Understanding the Complexity of Economic, Ecological, and Social Systems," *Ecosystems*, vol. 4, no. 5: pp. 390–405.
- Brian Walker et al. (2004). "Resilience, Adaptability and Transformability in Social-Ecological Systems," *Ecology and Society*, vol. 9, no. 2, art. 5.
- Carl Folke et al. (2010). "Resilience Thinking: Integrating Resilience, Adaptability, and Transformability," *Ecology and Society*, vol. 15, no. 4, art. 5.
- Marten Scheffer (2009). "Alternative Stable States," and "Conclusion: From Theoretical Concepts to Reality," chapters 2 and 6 in *Critical Transitions in Nature and Society* (Princeton: Princeton University Press): pp. 11-36, 96-105.
- Marten Scheffer et al. (2012). "Anticipating Critical Transitions," *Science* 338: pp. 344-48.

Further Reading:

- Marten Scheffer, video of 2011 WICI lecture "Early Warning Signs for Critical Transitions." <https://uwaterloo.ca/complexity-innovation/events/early-warning-signs-critical-transitions>.
- Brian Walker et al. (2020). "Navigating the Chaos of an Unfolding Global Cycle," *Ecology and Society*, vol. 25, no. 4, art. 23. <https://www.ecologyandsociety.org/vol25/iss4/art23/>.
- Craig R. Allen et al. (2014). "Panarchy: Theory and Application," *Ecosystems*, vol. 17: pp. 578-589.
- Scott Page (2011). *Diversity and Complexity*. Princeton, NJ: Princeton University Press.
- Brian Walker and David Salt (2006). *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Washington, DC: Island Press.
- Brian Walker and David Salt (2012). *Resilience Practice: Building Capacity to Absorb Disturbance and Maintain Function*. Washington, DC: Island Press.
- Lance H. Gunderson and C. S. Holling, eds. (2002). *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington, DC: Island Press.

Week 6: Feb. 16 – Global networks

*****Systems maps are due before the beginning of class via the dropbox on the course Learn site.** Late assignments will be penalized 2% per day, including weekends. Extensions will only be granted in cases of a valid and verified justification.

The world is increasingly organized into networks, and network analysis has become a powerful tool in the social sciences. After reviewing the basics of network analysis, we will explore different types of networks, the mechanisms by which networks grow, and the ways in which network structures condition outcomes. Networks create opportunities for contact and innovation, but many global networks are vulnerable to cascading failures. As such, networks are a major concern for globalization and global governance.

Readings:

- Guido Caldarelli and Michele Catanzaro (2012). *Networks: A Very Short Introduction*. Oxford: Oxford University Press.
- Miles Kahler (2009). "Networked Politics: Agency, Power, and Governance," in *Networked Politics: Agency, Power, and Governance*, edited by Miles Kahler. Ithaca, NJ and London, UK: Cornell University Press: pp. 1-20.
- Sergey V. Buldyrev et al. (2010). "Catastrophic Cascade of Failures in Interdependent Networks," *Nature*, vol. 464: 1025-1028.

Further Readings:

- Thomas Homer-Dixon et al. (2014). "The Conceptual Structure of Social Disputes: Cognitive-Affective Maps as Tools for Conflict Analysis and Resolution," *SAGE Open*, January-March 2014: pp. 1-20. Doi: 10.1177/2158244014526210.
- Jinelle Piereder (2021). "Network dynamics of the pandemic shock: three network shifts and why they matter." Inter-systemic cascades brief no. 9. The Cascade Institute. <https://cascadeinstitute.org/isc-brief/network-dynamics-of-the-pandemic-shock/>.
- Emilie M. Hafner-Burton, Miles Kahler, and Alexander H. Montgomery (2009). "Network Analysis for International Relations," *International Organization*, vol. 63, iss. 3: pp. 559-592.
- Moira V. Faul (2016). "Networks and Power: Why Networks are Hierarchical not Flat and What Can be Done About it," *Global Policy*, vol. 7, iss. 2: pp. 185-197.
- Jianxi Gao et al. (2015). "Recent Progress on the Resilience of Complex Networks," *Energies*, vol. 8: pp. 12187-12210. <https://www.mdpi.com/1996-1073/8/10/12187>.
- Michael D. Ward, Katherine Stovel, and Audrey Sacks (2011). "Network Analysis and Political Science," *Annual Review of Political Science*, vol. 14: pp. 245-264.

*****WINTER READING WEEK: Feb. 18 – 26 (No Classes)**

Week 7: Mar. 2 – Global systemic risk

In this session, we will consider the changing nature of global crises. *Systemic risks* refer to situations in which a small problem in one part of a system quickly spreads to disable the entire system, with effects that can spill over into other systems. The homogenization, mass consumption, and hyper-connectivity of globalization leave us increasingly vulnerable to these sorts of systemic failures. We will apply key concepts from week 5 (adaptive cycles, resilience, and critical transitions) to evaluate the global governance response to such risks, including the global financial crisis and the COVID-19 pandemic.

Readings:

- Dirk Helbing (2013). “Globally Networked Risks and How to Respond,” *Nature*, vol. 497: pp. 51-59.
- Jana Sillman et al. (2022). *ISC-UNDRR-RISK KAN Briefing Note on Systemic Risk*. Paris: International Science Council. <https://www.undrr.org/publication/briefing-note-systemic-risk>.
- Thomas Homer-Dixon et al. (2015). “Synchronous failure: The Emerging Causal Architecture of Global Crisis,” *Ecology and Society*, vol. 20, no. 3, art. 6. <https://www.ecologyandsociety.org/vol20/iss3/art6/>.
- Julia Kreienkamp and Tom Pegrarn (2021). “Governing Complexity: Design Principles for the Governance of Complex Global Catastrophic Risks,” *International Studies Review*, vol. 23: pp. 779-806.

Further Reading:

- Ortwin Renn et al. (2019). “Things are Different Today: The Challenge of Global Systemic Risks,” *Journal of Risk Research*, vol. 22, no. 4: pp. 401-415.
- Victor Galez et al. (2017). “Global Governance Dimensions of Globally Networked Risks: The State of the Art in Social Science Research,” *Risks, Hazards & Crisis in Public Policy*, vol. 8, no. 1: pp. 4-27.
- Miguel Centeno et al. (2015). “The Emergence of Global Systemic Risk,” *Annual Review of Sociology*, vol. 41: pp. 65-85.
- World Economic Forum, *Global Risks Report* (annual series): <https://www.weforum.org/global-risks/reports>.
- Ian Goldin and Mike Mariathan (2014). *The Butterfly Defect: How Globalization Creates Systemic Risks, and What to Do about It*. Princeton, NJ: Princeton University Press.
- Nick Bostrom and Milan M. Cirkovic, eds. (2008). *Global Catastrophic Risks*. Oxford and New York: Oxford University Press.

Week 8: Mar. 9 – Societal collapse

From the Roman Empire to the Easter Islanders, past examples of societal collapse are often touted as prophetic fables about our impending doom. Sensationalist accounts, however, scarcely countenance the *mechanisms* by which societies grow, lose resilience, decline, and collapse. Complex systems approaches offer more sophisticated treatments of such dynamics by examining the ways in which social systems generate and solve problems. After considering the basic meaning of ‘collapse,’ we will analyze several possible pathways to societal demise.

Readings:

- Joseph Tainter (1988). “Understanding Collapse: The Marginal Productivity of Sociopolitical Change,” chapter 4 in *The Collapse of Complex Societies* (Cambridge: Cambridge University Press): pp. 91-126.
- Michael Lawrence and Thomas Homer-Dixon (2021). “Pathways of Societal Collapse: The Inner Workings of Catastrophe,” paper presented at the International Studies Association Annual Convention. 7 April 2021.
- C. E. Richards, R. C. Lupton, and J. M. Allgood (2021). “Re-Framing the Threat of Global Warming: An Empirical Causal Loop Diagram of Climate Change, Food Insecurity and Societal Collapse,” *Climate Change*, vol. 165: art. 49.

Further Reading:

- Ugo Bardi, Sara Falsini, and Ilaria Perissi (2019). “Toward a General Theory of Societal Collapse: A Biophysical Examination of Tainter’s Model of the Diminishing Returns of Complexity,” *BioPhysical Economics and Resource Quality*, vol. 4, no. 3.
- Thomas Homer-Dixon (2006). *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization*. Toronto: Alfred A. Knopf Canada. Especially chapters 8 and 9.
- Robert Costanza, Lisa J. Graumlich, and Will Steffen, eds. (2007). *Sustainability or Collapse? An Integrated History and Future of People on Earth*. Cambridge, MA and London, UK: MIT Press.
- Graeme S. Cumming and Garry D. Peterson (2017). “Unifying Research on Socio-Ecological Resilience and Collapse,” *Trends in Ecology and Evolution*, vol. 32, no. 9: pp. 695-713.
- Guy D. Middleton (2017). *Understanding Collapse: Ancient History and Modern Myths*. Cambridge: Cambridge University Press.
- Karl W. Butzer (2012). “Collapse, Environment, and Society,” *Proceedings of the National Academy of Sciences U.S.A*, vol. 109, no. 10: pp. 3632-3639.
- Seshat Global History Databank: <https://seshatdatabank.info/>.
- Turchin, Peter (2003). *Historical Dynamics: Why States Rise and Fall*. Princeton and Oxford: Princeton University Press.

Week 9: Mar. 16 – Complexity, world order, and global governance

*****Thematic Analyses are due before the beginning of class via the dropbox on the course Learn site.** Late assignments will be penalized 2% per day, including weekends. Extensions will only be granted in cases of a valid and verified justification.

The field of International Relations is for many synonymous with system-level theory, but systems thinking remains deeply impoverished within the discipline. Complexity approaches can build a much richer understanding of world politics and global governance by addressing two of the biggest failings of orthodox perspectives. First, rather than taking states for granted as unitary and universal actors, complexity approaches help endogenize the emergence, development, and co-evolution of actors within the broader evolution of world order. Second, the complexity literature offers tools with which to theorize and understand *change* in world politics. More fundamentally, we will ask whether complexity represents a helpful set of concepts and tool that supplement existing frameworks, or whether complexity represents an essentially new and generative approach to the study of world politics.

Readings:

- Lars-Erik Cederman (1997). "Modeling Actors in World Politics," chapter 2 in *Emergent Actors in World Politics: How States and Nations Develop and Dissolve*. Princeton, NJ: Princeton University Press: pp. 14-36.
- Antoine Bousquet and Simon Curtis (2011). "Beyond Models and Metaphors: Complexity Theory, Systems Thinking and International Relations," *Cambridge Review of International Affairs*, vol. 24, no. 1: pp. 43-62.
- Seva Gunitsky (2013). "Complexity and Theories of Change in International Politics," *International Theory*, vol. 5, no.1: pp. 35-63.

Further Reading:

- Special Issue on Complexity and International Relations, *Cambridge Review of International Affairs*, vol. 24, no. 1 (2011).
- Michael Lawrence (2019). *Violence, Conflict, and World Order: Rethinking War with a Complex Systems Approach*. Doctoral thesis presented to the University of Waterloo. <https://uwspace.uwaterloo.ca/handle/10012/15545>.
- Emilian Kavalski, ed. (2015). *World Politics at the Edge of Chaos: Reflections on Complexity and Global Life*. Albany, NY: State University of New York Press.
- Mathias Albert, Lars-Erik Cederman and Alexander Wendt, eds. (2010). *New Systems Theories of World Politics*. Basingstoke, UK: Palgrave Macmillan.
- Maren Wagner (2016). *Social Emergence in International Relations: Institutional Dynamics in East Asia*. Switzerland: Palgrave Macmillan.
- Sylvia Walby (2009). *Globalization and Inequalities: Complexity and Contested Modernities*. Los Angeles: Sage.

Week 10: Mar. 23 – Complexity in policy and practice

The nonlinearities, chaotic behaviours, path dependencies, and unpredictability of complex systems pose immense challenges for leadership and management. In this session, we will consider the implications of uncertainty and then explore the possible leverage points at which interventions can set off change in complex systems, focussing especially on possibilities for ideational change. We will then consider the strengths and weaknesses of scenario planning and robust decision making as policy tools tailored to complex and uncertain conditions.

Readings:

- **Review, from week 1:** Thomas Homer-Dixon (2011). "Complexity Science," *Oxford Leadership Journal*, vol. 2, no. 1: pp. 1-15. <https://homerdixon.com/wp-content/uploads/2017/05/Homer-Dixon-Oxford-Leadership-Journal-Manion-lecture.pdf>.
- Donella Meadows (1999). "Places to Intervene in a System." The Sustainability Institute. https://donellameadows.org/wp-content/userfiles/Leverage_Points.pdf.
- Ford, Christopher A. (2015). "Musings on Complexity, Policy, and Ideology," in Emilian Kavalski, ed., *World Politics at the Edge of Chaos: Reflections on Complexity and Global Life* (Albany, NY: State University of New York Press), pp. 79-109.
- Marta Barbés-Blázquez et al. (2022). "Resilience in the Times of COVID: What the Response to the COVID Pandemic Teaches us about Resilience Principles," *Ecology and Society*, vol. 27, no. 2, art. 16. <https://ecologyandsociety.org/vol27/iss2/art16/>.
- Steven Bernstein et al. (2000). "God Gave Physics the Easy Problems: Adapting Social Science to an Unpredictable World," *European Journal of International Relations*, vol. 6, no. 1: pp. 43-76. **Read pp. 43-59.**
- Paul Watkiss and J. Dynzynski (2013). "Robust Decision Making." Decision Support Methods for Climate Change Adaptation Briefing Note 3. MEDIATION Project. <https://www.weadapt.org/system/files/force/robust-decision-making.pdf?download=1>.

Further Reading:

- W. E. Walker et al. (2003). "Defining Uncertainty: A Conceptual Basis for Uncertainty Management in Model-Based Decision Support," *Integrated Assessment*, vol. 4, no. 1: pp. 5-17.
- David J. Snowden and Mary E. Boone (2007). "A Leader's Framework for Decision Making," *Harvard Business Review*, <https://hbr.org/2007/11/a-leaders-framework-for-decision-making>.
- David Peter Stroh (2015). *Systems Thinking for Social Change: A Practical Guide to Solving Complex Problems, Avoiding Unintended Consequences, and Achieving Lasting Results*. White River Junction, VT: Chelsea Green Publishing.
- Michele-Lee Moore, Darcy Ridell, and Dana Vocisano (2015). "Scaling Out, Scaling Up, Scaling Deep: Strategies of Non-Profits in Advancing Systemic Social Innovation," *The Journal of Corporate Citizenship*, iss. 58: pp. 67-84.

- Jean Boulton (2010). “Complexity Theory and Implications for Policy Development,” *Emergence: Complexity and Organization*, vol. 12, no. 2: pp. 31-40.
- Horst W. J. Rittel and Melvin B. Webber (1973). “Dilemmas in a General Theory of Planning,” *Public Sciences*, vol. 4: pp. 155-169.
- David Colander and Roland Kupers (2014). *Complexity and the Art of Public Policy: Solving Society’s Problems from the Bottom Up*. Princeton and Oxford: Princeton University Press.
- Robert Geyer and Samir Rihani (2010). *Complexity and Public Policy: A New Approach to Twenty-First Century Politics, Policy and Society*. London: Routledge.

Week 11 (Mar. 30) and Week 12 (Apr. 6) – Student Presentations

Over these final two sessions, each student will present their final essay research and moderate a class discussion of their findings. We will consider how complexity thinking can be productively applied to real world challenges of global governance in such spheres as conflict and security, political economy, and the environment.

Readings may be assigned (sparingly) as preparation for these sessions. In the meantime, the following lists of recommended readings may help you to develop your topic and apply a complex systems lens to your work.

Complexity and Environmental Governance:

- Will Steffen et al. (2018). “Trajectories of the Earth System in the Anthropocene,” *Proceedings of the National Academy of the Sciences*, vol. 115, no. 33: pp. 8252-8259.
- Chi Xu et al. (2020). “Future of the Human Climate Niche,” *Proceedings of the National Academy of the Sciences*, vol. 117, no. 21: pp. 11350-11355.
- Abrahm Lustgarten (2020). “The Great Climate Migration Has Begun,” *The New York Times Magazine*. July 23.
<https://www.nytimes.com/interactive/2020/07/23/magazine/climate-migration.html>.
- Anthony D. Barnosky and Elizabeth Anne Hadly (2016). *Tipping Point for Planet Earth: How Close are we to the Edge?* New York: Thomas Dunne Books, St. Martin’s Press.

Complexity and Political-Economic Governance:

- Fabio Caccioli, Paolo Barucca, and Teruyoshi Kobayashi (2018). “Network Models of Financial System Risk: A Review,” *Journal of Computational Social Science*, vol. 1: pp. 81-114.
- Thomas Oatley (2019). “Towards a Political Economy of Complex Interdependence,” *European Journal of International Relations*, vol. 25, no. 4: pp. 957-978.
- Eric D. Beinhocker (2006). *The Origin of Wealth: The Radical Remaking of Economics and What It Means for Business and Society*. Boston: Harvard Business School Press.

- W. Brian Arthur (2014). *Complexity and the Economy*. Oxford and New York: Oxford University Press.

Complexity, Conflict, and Security Governance:

- Lars-Erik Cederman (2003). "Modelling the Size of Wars: From Billiard Balls to Sandpiles," *American Political Science Review*, vol. 97, no. 1: pp. 135-150.
- Antoine Bousquet (2012). "Complexity Theory and the War on Terror: Understanding the Self-Organising Dynamics of Leaderless Jihad," *Journal of International Relations and Development*, vol. 15, no. 3: pp. 345-369.
- Michael Lawrence, *A Complex Systems Approach to the Drug War in Mexico: Resources, Violence and Order*. WICI Occasional Paper no. 1. Waterloo: Waterloo Institute for Complexity and Innovation. <https://uwaterloo.ca/complexity-innovation/resources/wici-occasional-papers#no1>.
- Cedric de Coning (2018). "Adaptive Peacebuilding," *International Affairs*, vol. 94, vol. 2: pp. 301-317.
- Michael Kenney (2007). *From Pablo to Osama: Trafficking and Terrorist Networks, Government Bureaucracies, and Competitive Adaptation*. University Park, PA: Pennsylvania State University Press.
- Michael T. Klare (2019). *All Hell Breaking Loose: The Pentagon's Perspective on Climate Change*. New York: Metropolitan Books.

*****Final Essays are due Friday, April 21 by midnight EST.** Late assignments will be penalized 2% per day, including weekends. Extensions will only be granted in cases of a valid and verified justification.