

GE0873-001: Seminar in Human-Environment Geography

3 Credits, Spring 2023

Department of Geography, Environment, & Spatial Sciences, Michigan State University

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Guest Lectures

Jack Liu, MSU; liuji@msu.edu

Peilei Fan, MSU; wfang@pace.edu

Suraj Upadhaya, Iowa State University; upadhaya@iastate.edu

Venkatesh Kolluru, University of South Dakota; Venkatesh.Kolluru@coyotes.usd.edu

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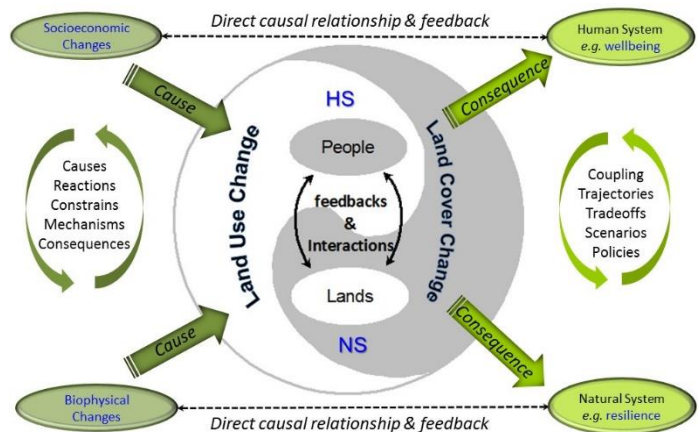
Time: Wed., 12:40 am -3:30 pm

Office Hour: Fri., 12:00 am – 2:00 pm, Geography 212; or by appointment

Location: 120 Geography bldg.

Description

This class will provide a forum to examine the broad range of approaches being used by scientists to address human-environment systems, and the integration of social and natural sciences. We will look at expert panel assessment of what the urgent questions are driving research at this time (and how this has changed over time), and how a range of teams are approaching the challenge of coupling the natural and social systems to address issues such as global change, climate change, food security, land use/cover, and sustainability. This goal will be achieved through reviews of the UpToDate literature, term papers, (guest) lectures, and hands-on homework. Several PIs of NSF's DYSES are invited for guest lectures.



Reading Materials

Chen, J. (2023). Unlocking the Power of Machine Learning for Earth System Modeling: A Game-Changing Breakthrough. *Global Change Biology*.

Chen, J., John, R., Zhang, Y., Shao, C., Brown, D. G., Batkhishig, O., ... & Qi, J. (2015). Divergences of two coupled human and natural systems on the Mongolian Plateau. *Bioscience*, 65(6), 559-570.

Chen, J., John, R., Yuan, J., Mack, E. A., Groisman, P., Allington, G., ... & Qi, J. (2022). Sustainability challenges for the social-environmental systems across the Asian Drylands Belt. *Environmental Research Letters*, 17(2), 023001.

Chen, J., John, R., Shao, C., Ouyang, Z., Mack, E. A., Henebry, G. M., ... & Abraha, M. (2021). Towards a single integrative metric on the dynamics of social-environmental systems. *Sustainability*, 13(20), 11246.

- Fan, P., Ouyang, Z., Nguyen, D. D., Nguyen, T. T. H., Park, H., & Chen, J. (2019). Urbanization, economic development, environmental and social changes in transitional economies: Vietnam after Doimoi. *Landscape and urban planning*, 187, 145-155.
- Filatova, T., Polhill, J. G., & Van Ewijk, S. (2016). Regime shifts in coupled socio-environmental systems: Review of modelling challenges and approaches. *Environmental modelling & software*, 75, 333-347.
- Herrero-Jáuregui, C., Arnaiz-Schmitz, C., Reyes, M. F., Telesnicki, M., Agramonte, I.,... & Montes, C. (2018). What do we talk about when we talk about social-ecological systems? A literature review. *Sustainability*, 10(8), 2950.
- Haughton, G. (1999). Environmental justice and the sustainable city. *Journal of Planning Education and Research*, 18(3), 233-243.
- Hickel, J. (2020). The sustainable development index: Measuring the ecological efficiency of human development in the Anthropocene. *Ecological Economics*, 167, 106331.
- IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. (as a reference, not required to read this 3949-page document)
- Krausmann, F., Erb, K. H., Gingrich, S., Haberl, H., Bondeau, A., Gaube, V., ... & Searchinger, T. D. (2013). Global human appropriation of net primary production doubled in the 20th century. *Proceedings of the national academy of sciences*, 110(25), 10324-10329.
- Lafortezza, R., Chen, J., Van Den Bosch, C. K., & Randrup, T. B. (2018). Nature-based solutions for resilient landscapes and cities. *Environmental research*, 165, 431-441.
- Liu, J., Dietz, T., Carpenter, S. R., Alberti, M., Folke, C., Moran, E., ... & Taylor, W. W. (2007). Complexity of coupled human and natural systems. *science*, 317(5844), 1513-1516.
- Liu, J., Dietz, T., Carpenter, S. R., Taylor, W. W., Alberti, M., Deadman, P., ... & Lubchenco, J. (2021). Coupled human and natural systems: The evolution and applications of an integrated framework. *Ambio*, 50(10), 1778-1783.
- Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, 325(5939), 419-422.
- Resilience Theory and Socio-Environmental Systems: <https://www.sesync.org/resources/resilience-theory-and-socio-environmental-systems>
- Robertson, G. P., Hamilton, S. K., Paustian, K., & Smith, P. (2022). Land-based climate solutions for the United States. *Global Change Biology*, 28(16), 4912-4919.
- Rubino, M., Etheridge, D. M., Trudinger, C. M., Allison, C. E., Rayner, P. J., Enting, I., ... & Smith, A. M. (2016). Low atmospheric CO2 levels during the Little Ice Age due to cooling-induced terrestrial uptake. *Nature Geoscience*, 9(9), 691-694.
- Silbernagel, J., Martin, S. R., Gale, M. R., & Chen, J. (1997). Prehistoric, historic, and present settlement patterns related to ecological hierarchy in the Eastern Upper Peninsula of Michigan, USA. *Landscape Ecology*, 12(4), 223-240.
- Turner, B. L., Esler, K. J., Bridgewater, P., Tewksbury, J., Sitas, N., Abrahams, B., ... & Mooney, H. (2016). Socio-Environmental Systems (SES) Research: what have we learned and how can we use this information in future research programs. *Current Opinion in Environmental Sustainability*, 19, 160-168.
- Venkatesh, K., John, R., Chen, J., Jarchow, M., Amirkhiz, R. G., Giannico, V., ... & Yuan, J. (2022). Untangling the impacts of socioeconomic and climatic changes on vegetation greenness and productivity in Kazakhstan. *Environmental Research Letters*, 17(9), 095007.

WebPages

- 1) AR6 report video, IPCC, 3/20/2023 (<https://www.youtube.com/watch?v=5vJJTE9V7EA>)

- 2) 10 Big Findings from the 2023 IPCC Report on Climate Change (<https://www.wri.org/insights/2023-ipcc-ar6-synthesis-report-climate-change-findings>)

Schedule (to be updated)

Jan 11: Introduction (<https://msu.zoom.us/j/99464870239>; Passcode: 086310)

Getting to know each other (student profile, template in PowerPoint)
Discussion on class format (options, grading, attendance, D2L vs listserv, etc.)
Case examples of coupled human and natural systems

- Settlements of native American in the Upper Peninsula, MI
- Story from Inner Mongolia – policy relevancy
- Historical influences of geopolitical conflicts and the Earth System
- Widespread human influences on the Earth: from “*Silent Spring*” to “*Guns, Germs, and Steel*”

Some major crises facing the global CHN systems.

- Global warming
- Loss of biological diversity
- Land degradations (fragmentation, land cover changes)
- Global demands for food, energy and water (FEW) and globalization
- Environmental justices
- Human health and infectious diseases
- Population growth and energy consumption
- Urbanization
- Pollutions (air, water, land)
- Cultural changes and losses

Reading: Silbernagel et al. (1997), Chen et al. (2015a)

Jan 18

A brief history of CNH concept: from IGBP to DYSES (NSF)
Discussion on group term paper
Presentation by Yousef
Scientific writing

Jan 25

Guest Lecture by Dr. Peilei Fan, Urban Sustainability; to build a solid understanding of theoretical concepts of urban sustainability.

Reading: Fan et al. (2019); Haughton (1999)

Feb 1

Art of Scientific Writing
Couple human and natural systems on the Mongolian Plateau
Group discussion on study objectives and timetable

Feb 8

Sustainability Challenges for the Social-Environmental Systems across the Asian Drylands Belt

Reading: Chen et al. 2022, ERL

Group discussion on the synthesis paper (3:00 pm -)

Feb 15

University closes for the week due the shooting on Tue.

Feb. 22 – Feb. 27

Change of class format

Quantitative descriptions of SES

Reading: Krausmann et al. 2013; Hickel 2020; Chen et al. 2021

Group discussion on the synthesis paper (3:00 pm -)

Homework 1: Summary of CNH concept and framework; Due 5:00 pm next Monday (Feb 27)

Homework 2, Reflection on quantitative methods for SES. This will be based on the readings and lectures from Feb 23 and March 1. It will be due before 5:00 pm of March 10.

March 1

1) Data mining, in-class exercise of accessing data from WB, FAO, etc.)

2) Introduction of Structural Equation Modeling (SEM)

Mar 15

1) SEM demonstrations in R' demonstration, Venkatesh Kolluru, University of South Dakota; and Gabriela Shirkey, The LEES Lab, MSU

2) Case studies using SEM in SES research

Reading: Venkatesh et al. 2022

Mar 22-29

Global climate change and consequences (ecosystems and societies)

(1) The physical foundation

(2) Consequences

(3) Adaptation and mitigation

(4) Kyoto Protocol and beyond

Reading:

- AR6 report video, IPCC, 3/20/2023 (<https://www.youtube.com/watch?v=5vJJTE9V7EA>)
- 10 Big Findings from the 2023 IPCC Report on Climate Change (<https://www.wri.org/insights/2023-ipcc-ar6-synthesis-report-climate-change-findings>)
- IPCC, 2021: Summary for Policymakers.

Homework 3: Based the lectures, reading materials and your knowledge (from your own research) on global climate change and impacts, select a topic of own interest and provide your vision on the research needs for addressing 1-2 major challenges in global climate changes.

Due: 5:00 pm, 4/3/2023

Apr 5

Globalization & local practices: food, energy, water and infectious diseases

Renewable energy: Bioenergy, solar, wind, earth heat, etc.

Reading:

Chen, J. (2023). Unlocking the Power of Machine Learning for Earth System Modeling: A Game-Changing Breakthrough. *Global Change Biology*.

Apr 12

Guest Lecture by Dr. Suraj Upadhaya, Iowa State University

“Uncovering landowners' behaviors of conservation practices adoption in agricultural landscape-a social-ecological perspectives”

Reading:

Robertson, G. P., Hamilton, S. K., Paustian, K., & Smith, P. (2022). Land-based climate solutions for the United States. *Global Change Biology*, 28(16), 4912-4919.

Lafortezza, R., Chen, J., Van Den Bosch, C. K., & Randrup, T. B. (2018). Nature-based solutions for resilient landscapes and cities. *Environmental research*, 165, 431-441.

Homework 4: In the remaining 3-4 weeks, we will discuss issues on global food, energy, and water (FEW). You will select a focal topic of FEW nexus and report the lessons from the lectures, reading materials, as well as your own literature search.

Apr 19

- Guest lecture by Dr. Jack Liu, CHANS & Telecoupling
- Water (transboundary water)
- Q/A on student presentations

Reading:

Liu, J., Dietz, T., Carpenter, S. R., Alberti, M., Folke, C., Moran, E., ... & Taylor, W. W. (2007). Complexity of coupled human and natural systems. *Science*, 317(5844), 1513-1516.

Liu, J., Dietz, T., Carpenter, S. R., Taylor, W. W., Alberti, M., Deadman, P., ... & Lubchenco, J. (2021). Coupled human and natural systems: The evolution and applications of an integrated framework. *Ambio*, 50(10), 1778-1783.

Apr 26

- Student presentation (10-15 min each)
- Teaching evaluations