

Geography 520 : Spring 2015
Geographic Information Representation Seminar:
Explorations into Sustainability Information Science
Thursday 2:30-5:20PM, Smith Hall 111
<http://courses.washington.edu/geog520>

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Office Hours: by appointment

Course Learning Objective:

Provide students an opportunity to explore ideas associated with new developments in geographic information science and technology, particularly as related to sustainability information science.

Course Overview:

We live in a world of continual change in space and time. Slow and fast changes occur simultaneously depending on what and how human-environment interactions are considered within dynamic coupled human-natural systems, social-ecological systems, human-environment systems, or whatever the conceptualization. Slow and fast change is relative to scale. Scales of space and time help us contextualize those changes, wherein there is much to be understood about geographic dynamics at different spatial-temporal scales. This research seminar explores geographic dynamics within the context of sustainability information science (SIS). SIS is viewed as a bridge between sustainability science (SS) and sustainability management (SM). In other words, SIS is cast as the science of methods to support knowledge to action moving from SS to SM (and back as needed) to address large-group, multi-stakeholder, collaborative decision problems. SS is the science of complex adaptive systems, characterized as coupled human-natural systems composed of diverse human-environment interactions. SM is thought of as the practice of sustainability science; in other words, how to put knowledge to action in a decision support context. SIS embraces a multi-stakeholder perspective, taking participatory geographic information science to a next level. SIS is much about representing spatial-temporal dynamics of human-environment interaction in dynamic coupled human-natural systems, etc. This requires developing a sustainability information representation theory (SIRT) as the core of SIS.

Three intertwined perspectives are helpful in understanding complex systems from a SM, SS, and SIS perspective. One perspective is a substantive perspective that deals with phenomena known through shared experiences in the everyday world. A second perspective involves methods about how we can measure and come to better know the character of phenomena in/of world(s). A third perspective is a conceptual perspective that formulates ideas about the link between our substantive and methodological perspectives to provide us with meaning about/in/of the world.

All three perspectives, which could be considered knowledge domains, are in play simultaneously, and very useful to understanding the differences, but also connections in sustainability science, sustainability information science, and sustainability management. Which perspective (domain) leads as a primary emphasis, which domain follows as secondary emphasis,

and which domain provides support to round out the overall perspective establishes the character of research. Sustainability science knowledge emerges from basic research wherein concepts lead the perspective. Sustainability information science knowledge emerges from method-driven research wherein methods are of most significance. Sustainability management knowledge emerges from applied research wherein substance is most fundamental.

We need a balance in the three domains (perspectives) to come to know more about sustainability. When the three views come into correspondence (element to element and relationship to relationship) then we build fundamental understanding about how the world is changing, in space and time; that is, our theory, methods, and referent substance are all in “sync”. A major question underlies progress: How can we better “sync” the domains to develop broadly applicable and deeply informative software for practical sustainability purposes through a methods-driven science of sustainability? Pursuit of that ‘sync’ can be called a knowledge-to-action SIS.

SIS is posed as a bridge developing through exploration of geographic (spatial-temporal) information representation of seven concepts that include sustainable systems, resilience, vulnerability, risk, adaptation, transformation, and sustainability, and the conceptual relations between them for implementation in geographic information systems (GIS). To better understand those concepts and ways to implement them in software we will explore a conceptual framework that arrays information representation in terms of four domains that tier: 1) a foundation of spatial-temporal dynamics, 2) sustainability, 3) geodesign methods, and 4) applications software. Each tier builds on the next (from 4 to 1) or embeds in the next (from 1 to 4) to better understand how to compute with sustainability information. SIRT at the core of SIS is an important extension to concepts in geographic information science, and as such, a foundation for future participatory cyber-enabled geographic information systems (CyberGIS) for supporting high performance computing and collaboration in complex problem solving. This seminar explores the above concepts through a SIS lens as we posit the opportunities for developing a geodesign platform as a big next-step in the innovations about CyberGIS.

Prerequisite: Background in at least one course in GIS, interest in sustainability and GIS, or Instructor’s permission.

Required Reading*

- *McElvaney, S. 2012. *Geodesign: Case Studies in Regional and Urban Planning*, Esri Press, Redlands.
- *Nyerges, T., Mary Roderick, Steven Prager, David Bennett, & Nina Lam 2014. Foundations of sustainability information representation theory: spatial-temporal dynamics of sustainable systems, IJGIS, available online
<http://www.tandfonline.com/doi/abs/10.1080/13658816.2013.853304#.Un0G5CcVGS0>
- *Nyerges, T. and M. Roderick 2012, *Toward Sustainability Information Science*, draft manuscript, 89 pp.
- *Nyerges, T. and P. Jankowski 2012, *Regional and Urban GIS: A Decision Support Approach*; Decision situation assessment – Ch 4
- *Steinitz, C. 2012. *A Framework for Geodesign: Changing Geography by Design*, Esri Press, Redlands

*Walker, B. and D. Salt 2012 *Resilience Practice*, Washington, D.C., Island Press.

Optional Book – but very useful

Walker, B. and D. Salt 2006. *Resilience Thinking*, Washington, D.C., Island Press.

Basis of Grades

1. Class participation (25% of course grade) - All members of the seminar are responsible for reading the suggested items each week. All students are responsible for bringing **two copies of two discussion questions/issues** to each class session based on interests/questions associated with each of the readings; and be prepared to discuss the question answer/issue. One copy of these questions/issues is for Tim Nyerges; the other copy is for student reference and to keep a record of interests from that session. Students will use the questions/issues in developing a *course synthesis essay (section below)*. After each class students should write into a journal their impressions about topics discussed in class as relevant to their own questions/issues. This reflection activity will help students with the course synthesis essay, based on experience students have shared in the past.

2. Course synthesis essay (25% of course grade) - A course synthesis essay is to be compiled using the questions/issues and responses generated for each class discussion. This synthesis is to focus on the learning outcomes you have attained in the class relevant to your subject interest - preferably your own research topic. Taking a subject matter of your concern you should ask yourself the following question before and after each seminar session. How has this seminar session contributed to a better understanding (confusion) of the topics associated with that subject? The Course Synthesis Essay is due the last class day and will be the topic of discussion for that last session.

3. Research paper (50% of course grade) - Please see/email Tim Nyerges early in the course to discuss a research topic of interest to you. The research paper will be your interpretation of design and use of geographic information representations in relation to a topic of your choice related to sustainability information science. The paper is to be approximately 15 double-spaced pages in length (a bit more or less is OK), not including the diagrams and references. The research paper is due on the Monday of finals week.

Geography 520 Course Schedule
Geographic Information Representation Seminar:
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*required reading as designated below.

Week 1. April 2 Introduction to Fundamental Concepts

*Nyerges, [Toward SIS Powerpoint presentation](#)

What is the sustainability triad SS, SM, and SIS?

What is geographic information representation research and practice and how does it relate to sustainability?

What is geodesign methodology and what is participatory geospatial decision support?

Week 2 April 9 Toward a Sustainability Information Science

*Nyerges and Roderick, Toward SIS draft manuscript, Read as much as you like

*Nyerges, T., Mary Roderick, Steven Prager, David Bennett, & Nina Lam 2014. Foundations of sustainability information representation theory: spatial-temporal dynamics of sustainable systems, IJGIS, available online

<http://www.tandfonline.com/doi/abs/10.1080/13658816.2013.853304#.Un0G5CcVGS0>

Tier 1: Why use sustainable systems as the core of SIS?

Tier 2: What is geographic information representation research and practice in light of seven concepts: sustainable systems, resilience, vulnerability, risk, adaptation, transformation, and sustainability, and the conceptual relations between them?

How is geodesign methodology useful for sustainability decision support?

Week 3 April 16 Geodesign Methodology and Applications

*McElvaney Geodesign Case Studies: Ch 1

*Steinitz Geodesign Framework: Ch 1

Tier 3: What is geodesign methodology and why use it for participatory decision support?

What are the fundamental constructs for: 1) Representation modeling, 2) Process modeling, 3) Scenario evaluation modeling, 4) Change modeling, 5) Impact modeling, and 6) Decision modeling

Tier 4: Applications – you choose your favorite

Week 4 April 23 Geodesign Case Studies for Sustainability

Tim Nyerges will be at the American Association of Geographers Annual Meeting

Meet to discuss...

*McElvaney Geodesign Case Studies: read two case studies, be prepared to discuss in light of Geodesign Framework

*Steinitz Geodesign Framework case studies, read two other chapters

Week 5 April 30 Decision Situation Assessment for Geodesign Best Practices

*Regional and Urban GIS Chap 4 Decision Situation Assessment Framework

*Geodesign Case Framework .pdf

How would you synthesize a case framework (geodesign decision support cases) suitable for best practice compilation?

Week 6 May 5-8 Geodesign Week on UW Campus

May 5: Steinitz Public Lecture, time and room to be

May 6-8 Geodesign Workshop OUGL 220

Week 7 May 14 From Resilience (SIS) Thinking to Resilience (SIS) Practice

*Nyerges, T. et al. Principles of Resilience Measurement, draft paper

*Walker and Salt 2012 Resilience Practice, Island Press Chapters 1 - 4

How does one conduct resilience practice?

Is this approach sufficiently robust for computerizing the concepts?

Week 8 May 21 Computing Sustainability Information Representation in Practice

*Nyerges, T. Computing Complex Sustainable Systems Resilience, draft paper

*Codd Data model reading.

What sub-concepts must be measured to compute sustainable systems and resilience?

Week 9 May 28

Tim Nyerges is at the UCGIS Symposium in Washington DC

No class unless you want to meet online.

Week 10 June 4 Computing with Sustainability Information Representations

What data model specification(s) is/are needed to compute sustainable systems, resilience, vulnerability, risk, adaptation, transformation, sustainability?

Week 11 June 9 Course Reflection and Assessment

Note this is finals week. We meet Tues June 9 in finals time slot 4:30-6:20 pm

*Synthesis reports due in class.

Discussion of synthesis reports to take place.