Geography 5113 Special Topics in GIScience:

**SCALE, RESOLUTION AND UNCERTAINTY IN GEOGRAPHICAL ANALYSIS**

**TIME AND LOCATION:** Fri 12:30-3:20pm in Guggenheim 201E  
**CLASS WEBSITE:** [http://www.colorado.edu/geography/leyk/geog_5113_2014/](http://www.colorado.edu/geography/leyk/geog_5113_2014/)  
**INSTRUCTOR:** Stefan Leyk, GUGG 201F, stefan.leyk@colorado.edu  
**OFFICE HOURS:** Tue 12:30-1:45pm or by appointment

**OVERVIEW:** Effects of scale and resolution are two of the most prominent phenomena in the Geography literature. The implications of scale and resolution for geographical analysis have been widely studied in various disciplines that use spatial data. Interestingly, the perspectives on scale and resolution in these different disciplines vary and manifest themselves in common well-known concepts such as the Modifiable Areal Unit Problem (MAUP), the Ecological Fallacy and the Fractals Concept. These concepts are of central importance for studying statistical associations, spatial non-stationarity in these associations and spatial dependence in data. The consideration of the level of aggregation of the spatial units helps to better understand the meaning of analytical results and to identify whether data reliably reflect the phenomenon or process of interest. A mismatch between the data and the scale at which a phenomenon operates causes complex forms of uncertainty, which can result in biased predictions and misleading interpretations. These uncertainties are the main driver for research on methodological advancement in spatial refinement, small area estimation and data fusion efforts. Interestingly, specific perspectives and practices to address the above problems and the resulting uncertainties have evolved in different disciplines.

Interdisciplinary research on complex systems and human-nature interactions has to integrate different kinds of (spatial and non-spatial) data. The differences between these data with regard to their level of abstraction, aggregation and generalization make this integration process a grand challenge. For example, a study of environmental exposure requires data on population (census-enumerated), environmental data (e.g., terrain as raster data with a certain resolution) as well as data for the pollutant of interest (e.g., field-based measurements of NO₂ concentrations at point locations). Modeling exposure through spatial overlay and incorporating statistical models can seriously bias analysis and limit the validity of results without further data integration efforts.

This seminar focuses on scale and resolution effects. Through an uncertainty lens we will critically analyze research studies from different fields within Geography and identify how the above issues are addressed and resolved. This includes contributions from Census Geography, Health Geography, Landscape Analysis, Land Cover and Land Use Studies, Urban Geography, Risk Analysis and Geomorphology. Students will develop more advanced knowledge of the differences in conceptual and theoretical perspectives on scale and resolution that still persist within the field. Students will also better understand the role of the spatial sciences and various methodological contributions to support geographical analysis and develop strategies to incorporate this into their own research.

**CLASS MEETINGS** consist of lectures, student presentations, discussions and in-class exercises based on the readings announced. Each student will give one presentation on a particular reading topic and lead the follow-up discussion during the class sessions. During the semester students will work on a small semester project that can be connected to their own research (see below). Each student will deliver a short status presentation and a final presentation on the final project at the end of the semester, and write a term paper. During discussions students are expected to be active and prepared.

**TERM PROJECTS:** You will design and propose one topic for your semester project, which can be related to your graduate research. A proposal of ca. 400 words has to be submitted by Feb 07, 2014 (week 04). You should start preparing basic data to have them ready when the project starts. It might be useful to look through the literature ahead to find ideas for your project. I will comment on your proposals and require some revision if necessary. The project period is anticipated from week 7 to week 16. As mentioned, at the end of the semester each student will give a final presentation about the work done. Final papers are due May 02, 2014.

**PREREQUISITES:** The course is designed for graduate students from Geography, Environmental Sciences, Geology, Ecology or Information Sciences with experience in GIScience or Remote Sensing, statistics and spatial analysis.

**READINGS:** We will mainly rely on research and review papers from different sources. Below a preliminary list of references is given. All required readings will be available as PDF documents on the class website.

**GRADING:** The class grade is based on 200 points in total.  
- **Reading presentation and discussion lead** (50 points)  
- **Class participation** and attendance (20 points)  
- **Status presentation** (15 points) and **final presentation** (40 points)  
- **Proposal** (15 points) and **Term paper** (60 points).
## Schedule Spring 2014

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<tr>
<th>W</th>
<th>DATE</th>
<th>LECTURE</th>
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<tr>
<td>1</td>
<td>17 Jan</td>
<td>Introduction, basic concepts in geographical analysis, uncertainty; Student research topics</td>
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| 2 | 24 | Pixels & objects? Multi-scale land cover classification and landscape analysis | Dingle Robertson & King (2011); Hall et al. (2004)  
*Background:* Meentemeyer (1989) |
| 3 | 31 | Small area estimates and dasymetry in census geography: Integrating disparate data | Zandbergen & Ignizio (2010); Kim & Yao (2010)  
*Background:* Openshaw (1984a) |
| 4 | 07 Feb | Spatial units of vulnerability in risk/hazard analysis  
**Proposals due!!!** | Li et al. (2009); Mitsova et al. (2012)  
*Background:* Manley (2014) |
| 5 | 14 | MAUP and neighborhood effects in health geography | Flowerdew et al. (2008); Parenteau & Sawada (2011)  
*Background:* Piantadosi et al. (1988) |
| 6 | 21 | Data linkages in environmental health and exposure assessment studies | Young et al. (2009); Giordano & Cheever (2010)  
*Background:* Openshaw (1984a) |
| 7 | 28 | Resolution and scale effects in analyzing changes within peri-urban environments | Jacquem et al. (2008); Huang et al. (2009)  
*Background:* Marceau (1999) |
| 8 | 07 Mar | Scale-sensitive detection of vegetation disturbances: Data fusion and multi-resolution efforts | Hilker et al. (2009a); Neigh et al. (2008)  
*Background:* Dark and Bram (2007) |
| 9 | 14 | Multi-scale perspectives of landforms in Geomorphology | Deng & Wilson, 2008; Drăguț et al. (2011)  
*Background:* Goodchild (2011) |
| 10 | 21 | Scale and data resolution in assessing human-environment interactions for land use | Van Delden et al. (2011); Victoria et al. (2005)  
*Background:* Lam & Quattrochi (1992) (???) |
| 11 | 28 | SPRING BREAK | |
| 12 | 04 Apr | Effects of scale in landscape ecology and conservation studies | Wu (2004); Stickler & Southworth. (2008)  
*Background:* Jelinski and Wu (1996) |
| 13 | 11 | Status presentations and Guest lecture: Matt Ruther | tba |
| 14 | 18 | Status presentations and Guest lecture: Dan Runfola | tba |
| 15 | 25 | Final presentations & Discussion | |
| 16 | 02 May | Final presentations & Discussion | Final papers due: Fri, May 02 at 8pm |

### Session Plan (Tentative)

**Weeks 02-10:**

- **12:30-1:00pm:** Introduction to the course, admin, planning and outline of the seminar

**Weeks 02-10:**

- **12:30-1:00pm:** Quick review & feedback; Introduction to new topic; Project advice  
- **01:00-1:40pm:** Student presentation on readings  
- **01:40-2:00pm:** Break  
- **02:00-3:00pm:** Discussion led by student  
- **03:00-3:20pm:** Wrap-up, exercises, conclusions

**Weeks 12-14:**

- **12:30-02:10pm:** Status presentations (5min break after)  
- **02:10-02:20pm:** Break  
- **02:20-03:20pm:** Guest lecture

**Weeks 15-16:**

- **12:30-03:20pm:** Final presentations and discussion (short breaks between presentations)
READINGS (* indicates reading material required for this seminar)


Victoria, F. B., Pereira, L. S., Teixeira, J. L., & Lanna, A. E. (2005). Multi-scale modeling for water resources planning and
management in rural basins. Agricultural Water Management, 77(1), 4-20.


Disability
If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu. If you have a temporary medical condition or injury, see Temporary Medical Conditions: Injuries, Surgeries, and Illnesses guidelines under Quick Links at Disability Services website and discuss your needs with your professor.

Religious observances
Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please let the instructor know about such conflicts as soon as you study the schedule for this semester in particular the exam dates.

Policy on Classroom Behavior
Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at http://www.colorado.edu/policies/classbehavior.html and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code

Policy on Discrimination and Harassment
The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. The University of Colorado does not discriminate on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation, or veteran status in admission and access to, and treatment and employment in, its educational programs and activities. (Regent Law, Article 10, amended 11/8/2001). CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, or veteran status. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. Information about the ODH, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://www.colorado.edu/odh

Policy on Plagiarism
All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and at http://www.colorado.edu/academics/honorcode/

Department of Geography Code of Conduct
In the Department of Geography, instructors strive to create an atmosphere of mutual trust and respect in which learning, debate, and intellectual growth can thrive. Creating this atmosphere requires that instructors and students work to achieve a classroom in which learning is not disrupted. At the most basic level, this means that everyone attend class, be prepared with readings and assignments completed, and that students pay attention. This means no conversations with friends, reading the newspaper, coming late, or leaving early. Such behavior is disruptive to the instructor and to your fellow classmates. These basics of classroom etiquette are an important means of building and showing mutual respect. Inevitably, however, disagreements will arise. Sometimes these disagreements will be about content, sometimes about grades or course procedures, and sometimes they will be about the treatment of participants in the class. In order to facilitate the resolution of these disagreements, the following guidelines should be followed by everyone:

- All interactions must be guided by mutual respect and trust.
- If you are bothered by some aspect of the class, identify what it is that is bothering you and center the discussion on that issue.
- Address issues that concern you early. Problems are easier to resolve before they fester.
- Consider whether it is best to address your concerns in class or in a separate appointment with the instructor. Remember, behavior that disrupts your fellow classmates is not acceptable.
- Abusive speech or behavior will not be tolerated in any interaction between students or between student and instructor. If an instructor feels that your speech or behavior is abusive, you will be asked to leave the room. If you believe an instructor has become abusive, you may leave the room and talk with the department chairperson. Debate and discussion can continue when all parties proceed with mutual respect.
- If mutual respect cannot be restored, either you or the instructor may take the issue to the department chairperson or the Campus Ombuds Office.
GEOG 5113

Spring, 2014

QUESTIONNAIRE

NAME_________________________ YEAR _________
(optional)

MAJOR_________________________ CONCENTRATION ________________

WHAT OTHER COURSEWORK have you taken related to Cartography / GIS / Remote Sensing, Environmental Modeling, Information Sciences, Set theories?

1. __________________________ 2. __________________________

3. __________________________ 4. __________________________

WHAT DO YOU EXPECT TO LEARN BY TAKING THIS SEMINAR?

__________________________________________________________________________________

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WHAT CONCERNS DO YOU HAVE ABOUT TAKING THIS SEMINAR?

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Thanks for filling this out. This will help us to understand more about you.