GEOG 361
GISCIENCE II: ANALYSIS AND APPLICATIONS
Syllabus

Time and Location:  
Section 001: Lecture: M W 1200-1320, Strand 313  
Section 010: Lab: T 1200-1320, Wilkinson 210 (Digital Earth Lab)

Instructor:  
James Watson  
watsonjr@coas.oregonstate.edu  
Strand 348  
Office Hours: Tues 3-4pm, Strand 348b

TA:  
Steven Johnson  
johnstev@oregonstate.edu  
Office Hours: Friday, 9-10am, digital earth lab in Wilkinson 210

Office hours:  
TBA or by appointment

Prerequisites:  
GEOG 360 [C-] or GEO 365 [C-] or GEO 465 [C-] or (FE 257 and PH 211) and  
ST 201 OR ST 314 OR ST 351 or instructor approval.

Course Objectives:  
GEOG 361 is designed to introduce students to the theory and techniques of geospatial analysis.  
This course focuses on developing a foundation in geospatial reasoning and problem-solving skills.  
Building upon the introductory material presented in the pre-requisite courses, this course will  
guide students through the process of developing and carrying out geospatial analyses using  
various spatial data, techniques and models.  It will culminate in the completion of a geospatial  
analysis project developed by the student. Along with a written report, this project will also  
involve an oral presentation to your peers.

Student Learning Outcomes:  
In following this course, students will:  
• Geospatial analytic techniques (distance/similarity, regression/prediction, clustering,  
  spatial pattern analysis)  
• Learn how to investigate geospatial problems  
• R, Markdown, Latex, Jupyter

Text:  
http://www.rspatial.org/

Class-time / Discussion board:  
Class time will be used to discuss and apply the concepts that are presented in the rspatial  
website, and in supplementary lecture material. Short in class lectures will reinforce the  
foundational material from the textbook and supplementary readings.

Labs / Project:  
1
Weekly labs will build upon R spatial skills and techniques building on basic coding technique taught early in the course. These weekly exercises as well as the weekly project assignments will form the foundation of techniques for the completion of an individual spatial analysis project. This individual project will culminate in a written paper as well as an oral presentation at the end of the term.

Assessments:
There will be NO midterm or final exams. All assessment will be based on the Lab and quiz R notebooks and the project.

Grading:
Grading will be based on lab assignments, assessments and a final project, along with participation either on the discussion board or in person.

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Lab Transcription Notebooks</td>
<td>30%</td>
</tr>
<tr>
<td>Quiz Notebooks</td>
<td>25%</td>
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<tr>
<td>Class participation</td>
<td>5%</td>
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<tr>
<td>Final Project and Presentations</td>
<td>40%</td>
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Final Course Letter grades will be assigned as follows:
- A = 93-100
- A- = 90-92
- B+ = 87-89
- B = 83-86
- B- = 80-82
- C+ = 77-79
- C = 73-76
- C- = 70-72
- D+ = 67-69
- D = 63-66
- D- = 60-62
- F = Anything less than 60

Canvas will be used to post results of all work as they are graded but letter grades are not assigned until the end of the term.

Grading Policy:
The due date for each assignment will be posted on Canvas when the assignment is made available. Each assignment is due by the stated date. The grade will be dropped by 10% a day from the due date for each 24 hours that an assignment is late. If you have a legitimate excuse for not being able to complete the assignment on time, you must present this excuse (Dr.’s note, jury duty, etc) to the instructor before the due date of the assignment.
Incompletes:
Incompletes (“I”) are only given for circumstances that are beyond the student’s control that prevent the completion of the course within the quarter. Official documentation may be required to support a student’s request for an incomplete. In addition, incompletes are only given when the student has successfully completed at least 50% of the course work before the incomplete is requested. In all cases, the remaining course work must be completed by the end of the next quarter. The instructor and student will decide on an appropriate timeline for the completion of the work within that deadline.
WEEK 1 (JAN 8) – Intro to R and Jupyter
Lecture 1: introduction to course, motivation, syllabus review, mind-map of the course, introduction to the cutting edge of geospatial analysis and applications and communication
Demo: introduction to jupyter, jupyter cheat sheet
Quiz: Jupyter cheat sheet
Read: Rspatial -- introduction to R (skim all of it as best you can)
Lab: Rspatial section: Spatial Data Manipulation chapters 1-4
Lecture 2: Project work: geospatial scientific experimental design (start developing ideas for project: identify system, question), identify project themes and split up into groups

WEEK 2 (JAN 15) – Spatial data types
Lecture 1: spatial data types (raster, vector), matrices, arrays, exploratory data analysis (distributions, outliers)
Demo: Scrape data from the web + exploratory data analysis
Lab: Rspatial Section Spatial Data Manipulation chapters 5-9, Introduction to R chapter 7
Quiz: Web-scraping demo in R and exploratory data analysis
Lecture 2: Project work: Iterate on question, mine literature for state of the art, identify data sources. Write introduction to paper.

WEEK 3 (JAN 22) – Distance, scale and networks
Lecture 1: calculating distance (in n-dimensions), scale, course-graining, grid scale.
Lab: Rspatial section Spatial Data Analysis chapters 1, 2
Lecture 2: networks, least-cost paths, network distance.
Quiz: Create and analyze a simple network

WEEK 4 (JAN 29) – Spatial pattern analysis
Lecture 1: Autocorrelation, interpolation
Lab: Rspatial section Spatial Data Analysis chapters 3, 4
Lecture 2: Project work: exploratory data analysis, figure story board, sketch out methods.
Quiz: Analyze autocorrelation / variogram for a given dataset
Note: James is giving the Integrative Biology talk Monday afternoon, students are invited to attend.

WEEK 5 (FEB 5) – Point-pattern analysis + Project work
Lecture 1: Point-pattern analysis
Lab: Project work and/or Rspatial section Spatial Data Analysis chapter 8
Lecture 2: Project work, figure generation and preparation of short-form presentation

WEEK 6 (FEB 12) – Regression
Lecture 1: Linear regression, local regression
Lab: Rspatial section Spatial Data Analysis chapters 6, 7
Lecture 2: Spatial regression

WEEK 7 (FEB 19) – Clustering, Network Analysis, Dynamical Modeling
Lecture 1: Clustering and network community structure
Lab: Rspatial section Spatial Data Analysis chapter 9, Students continue project work
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Lecture 2: Spatial dynamical modelling (metapopulations)
Quiz: Clustering

WEEK 8 (MAR 5) – Species Distribution Modeling + Project work
Lecture 1: Species Distribution Modeling
Lab: Students continue project work
Lecture 2: Project work: how to present one’s work: making nice figures, creating a narrative, use the Message Box: group activity (make message box for your project, pair up and discuss)
Quiz: Species Distribution Modeling and prepare 1st half of presentation using message box

WEEK 9 (MAR 5) – Project work
Lecture 1: Guest lecture on cutting edge geospatial analysis and applications.
Lab: Students continue project work
Lecture 2: Project work: how to present one’s work: how to make a good presentation in 12 minutes
Quiz: no quiz
Homework: finish project, prepare presentation

WEEK 10 (MAR 12) – Project work
Lecture 1: Student perform 10 minute projects presentations
Lecture 2: Student perform 10 minute projects presentations
Quiz: no quiz

WEEK 11 (MAR 19) – Finals Week
Lecture 1: Course review and reiteration.
No exams. Hand in all jupyter quiz and lab notebooks. Hand in project notebook and published version.