Please complete this form and attach a copy of the syllabus for new courses. Forward it as an email attachment to the Secretary of the Graduate Council. A printed copy of the form with signatures should be brought to the Graduate Council Meeting. Complete the Coordinator Form on page 2, if changes in this course will affect other units.

Please indicate:  __X___ NEW    ____ MODIFY    ____ DELETE

Local Unit:  CAS Dept of Geography  Graduate Council Approval Date:  

Course Abbreviation: GEOG/EVPP (531) CSS(643) Course Number: 531 / 643

Full Course Title: Land-use modeling techniques and applications

Abbreviated Course Title (24 characters max.): Land-use modeling

Credit hours:  3  Program of Record:  Geography

Repeatable for Credit?  

_D=Yes, not within same term  Up to hours

_T=Yes, within the same term  Up to hours

_X_ N=Cannot be repeated for credit

Activity Code (please indicate):  

_x__ Lecture (LEC)  ___ Lab (LAB)  ___ Recitation (RCT)

___ Studio (STU)  ___ Internship (INT)  ___ Independent Study (IND)  ___ Seminar (SEM)

Catalog Credit Format  3: 3 : 0  Course Level:  GF(500-600)  __x__ GA(700+)

Maximum Enrollment: 24  For NEW courses, first term to be offered: The class was offered as a special topic in Spring 2003 and will be offered again in Spring 2004.

Prerequisites or corequisites: GEOG550, or permission of the instructor

Catalog Description (35 words or less)  Please use catalog format and attach a copy of the syllabus for new courses.: Survey of literature on spatially explicit empirical models of land-use change. Hands-on experience developing and running simple models. Techniques covered include statistical models, mathematical programming models, cellular automata, agent-based models, and integrated models.

For MODIFIED or DELETED courses as appropriate:

Last term offered:  

Previous Course Abbreviation:  

Previous number:

Description of modification:

APPROVAL SIGNATURES:

Submitted by:  

email:  _dparker3@gmu.edu

Department/Program:  

Date:  

College Committee:  

Date:  
Graduate Council Representative: ________________________________ Date: __________________
**GEORGE MASON UNIVERSITY**
*Course Coordination Form*

**Approval from other units:**

Please list those units outside of your own who may be affected by this new, modified, or deleted course. Each of these units must approve this change prior to its being submitted to the Graduate Council for approval.

<table>
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<tr>
<th>Unit: Environmental Science and Policy</th>
<th>Head of Unit’s Signature:</th>
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<td>Unit: Computation Social Science</td>
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Graduate Council approval: ___________________________ Date: ________

Graduate Council representative: __________________________ Date: ________

Provost Office representative: __________________________ Date: ________
Course Syllabus: GEOG590 002/ EVPP741 005: Land-Use Modeling Techniques and Applications

Instructor: Dr. Dawn Parker
Assistant Professor, Departments of Geography and Environmental Science and Policy
Office: Geography department, 4th floor, Robinson B, Room 477A
Phone: 703-993-4640
E-mail: dparker3@gmu.edu
Office hours: Tuesday 3-5; Wed. 6-7; and by appointment
Website: http://mason.gmu.edu/~dparker3

Meeting time and location: Wednesdays 7:20-10 PM, 106 Robinson B

Class Web Site: http://mason.gmu.edu/~dparker3/lucc_class/lumta

Course Description: The course surveys literature on spatially disaggregated (fine-scale) empirical models of land-use change (LUC). The course will begin with a discussion of factors that are hypothesized to drive land-use change across multiple spatial, institutional, and human scales and a discussion of issues related to LUCC modeling. The bulk of the course will be spent reviewing techniques for land-use modeling, including statistical and regression models, Markov models (briefly), cellular automata, mathematical programming and other optimization models, agent-based models, and integrated models. We will conclude with a discussion of the strengths, weaknesses, and potential complementarities of the models discussed. The role of geographic information systems as a tool for data management, analysis and visualization in land-use modeling will be discussed throughout the course. Readings will consist of excerpts from Briassoulis (1999), supplemented by articles from peer-reviewed literature. Students will be expected to have a working understanding of spatial data structures, geographic information systems, and statistical regression analysis, and to be comfortable manipulating and interpreting systems of linear equations.

The format of the class will consist of both lecture and discussion, with substantial emphasis on student participation. We have an exceptionally diverse and experienced population of graduate students at Mason, and I expect that you will learn at least as much from one another as you will from me. Thus, proportionally more class time will be devoted to interactive discussions than to lectures. With the exception of the first week of class, students will be expected to complete short writing assignments based on the week’s readings before class, and students will share responsibility for presenting a portion of the scholarly articles. When possible, examples of computerized implementations of the LUC models will be demonstrated in class and made available to students.

Goals of the Course: Having completed the course, students should be able to critically review and interpret a land-use model, whether presented in a report or scholarly article. They should have an understanding of the input data requirements, the ways in which the model output can be used, the spatial, temporal, and human scale over which the model operates, the disciplinary scope of the model, and the strengths, weaknesses, and limitations of the modeling technique used. Students should have an understanding of what empirical modeling techniques can be applied to a given data set. Finally, they should have an understanding of what modeling techniques are appropriate for particular research questions.

Recommended Prerequisites: An introductory GIS class, a quantitative methods class that includes statistical regression analysis, and the ability to follow and understand algebraic representations of systems of equations. Linear programming and calculus are helpful but not required.
Readings: All assigned readings will be available electronically. Many are available on-line without restrictions on downloading. Others will be made available through an electronic reader, under development. The link to this reader will be available here and on the class website when it is available. Readings for the first two weeks are available for download without restrictions.

Course Requirements and Grading: Your grade will be based on the following:

Short writing assignments and participation in class discussions (25%)  
Short, informal writing assignments related to the week’s reading will generally be assigned. The intent of these assignments is to help you distill and synthesize the week’s reading and to generate ideas for class discussions. These writing assignments should be coherent (complete sentences with reasonably correct grammar and spelling), but do not need to be edited and polished. Assignments will be due via e-mail by 9 AM class days (Wednesdays). Late short writing assignments will not be accepted. Assignments will be marked as missing (0), inadequate (1), adequate (2), or excellent (3). I would like to make the short writings available for the whole class, if students agree.

The 25% of your grade will be based on the combined content of both your short writings and participation in class discussion. Therefore, if you tend to be less verbose in class, you may want to put a bit more into the content of your short writings. Also, good questions from you will contribute substantially to your participation grade.

In-class presentations of required readings (25%)  
Each student will be responsible for presenting two papers from the methods sections of the course (weeks 4-13). The two papers must represent different modeling techniques. You will have the opportunity to request your preferred papers. Because the class schedule is very tight, if for any reason you cannot present your paper on the scheduled day, you will most likely be assigned a paper later in the semester as an alternative. For your assigned papers, please give a structured overview of the research question addressed by the paper, the modeling methodology used, the input data used by the model, the model outputs, and the authors’ interpretation of these outputs. Also, please comment on how effectively the model methodology addresses the research question posed by the authors, potential input data issues, the strengths and limitations of the authors’ approach, and improvements, extensions, or alternative applications of the model. Your presentation should be no longer than 20 minutes. We will have a computer if you wish to give an electronic presentation.

Term paper (25%)  
For the term paper, students may complete a targeted literature review, focusing either on application of a particular technique to specific phenomena, or on LUC models of a particular geographic region. Ideally, the relevant literature for the paper should encompass no more than 10-15 articles. (In other words – choose a well-focused topic!) Students with the requisite technical background and interest may undertake a simple LUC modeling project using one of the techniques that we review. The final paper should be 20-30 pages in length, double spaced 12 points font, including tables, figures, and bibliography. An extended abstract (up to 500 words) and paper bibliography will be due mid-semester, and final papers will be due April 23 and will be presented during the last two weeks of the class. Late papers will be penalized a quarter of a letter grade per day. Please review your potential paper topic with me before getting started.

Take-home final exam (25%)

The take-home final exam will be distributed the last day of class (April 30) and will be due at the end of our scheduled final exam period (May 7, regular class time). Late final exams will be penalized a half a letter grade per day and may result in a grade of incomplete in the class.
Please check before class to ensure that cell phones and pagers are turned off. Note that George Mason is an 
honor code university.

Weekly Schedule and Required Readings:

I. Introduction: Issues in Land-Use Change modeling and Drivers of LUC

Week 1 (Jan 22): General introduction
- Introduction to course, instructor, and fellow students
- Trends in LUC and their consequences
- LUC modeling concepts: definitions and discussion
- Brainstorming session: Drivers of LUC in Northern VA

Required readings (You do not need to complete these before the first class):

Briassoulis: Chapter 1 (Introduction) and Sections 4.1 and 4.2 (Modeling section introduction and classifications) 
http://www.rrri.wvu.edu/WebBook/Briassoulis/chapter1(introduction).htm
http://www.rrri.wvu.edu/WebBook/Briassoulis/Chapter4(Models1).htm#4.1
http://www.rrri.wvu.edu/WebBook/Briassoulis/Chapter4(Models1).htm#4.2

LUCC science plan: Executive summary and Section 3: 
http://www.geo.ucl.ac.be/LUCC/scienceplan/contents.html

Week 2 (Jan. 29): Overviews of LUCC models. Required readings:

Briassoulis: Chapter 2 (Historical Overview of Studies of LUC) 
http://www.rrri.wvu.edu/WebBook/Briassoulis/Chapter2(Histor overview).htm


Week 3 (Feb. 5): Urban and rural drivers of LUC Article requests for paper presentations due. Required readings:

Irwin and Geoghegan (2001) 
http://www.sciencedirect.com/science?_ob=MImg&_imagekey=B6T3Y-433P6Y4-G-T&cdi=4959&orig=browse&coverDate=06%2F30%2F2001&sk=999149998&wchp=dGLbVzb-ISzBS&acct=C000035118&version=1&userid=650615&md5=718f0f61dbf20cfe612eef29ca021f8&ie=UTF-8

Anas, Arnott, and Small (1999) 
http://links.jstor.org/sici?sici=0022-0515%28199809%2936%3A3%3C1426%3AUIUC%3E2.0.CO%3BZ

Geist and Lambin (2003) 
http://www.geo.ucl.ac.be/LUCC/pdf/02_February_Article_Geist_.pdf

Angelsen and Kaimowitz (1999) 
II. Statistical Models

Week 4 (Feb. 12) Required Readings:

Anselin (2002) (“Under the hood”) (not for student presentation) OR Briassolis, Chapter 4.3, Statistical and Econometric Models: http://www.rri.wvu.edu/WebBook/Briassoulis/Chapter4(models2).htm#4.5

Chomitz and Gray (1996)

Nelson and Hellerstein (1997)

Lambin (2000)

Week 5 (Feb. 19) Required Readings:

Bell and Irwin (2002) (not for student presentation)

Irwin (2002)

Walker et al. (2002)

Denninger and Minten (2002)

III. Markov and Cellular Automata Models

Week 6 (Feb. 26) Class cancelled, grrr!

Week 7 (March 5) Required Readings:

Batty (1997) (not for student presentation)

Torrens (2001) (not for student presentation)

White and Engelen (1993)

Clark (1997)

Week 8 (March 12): Spring break; no class

Week 9 (March 19) Required Readings:

Webster (1999)

Jenerette and Wu (2001)

Yeh and Li (2002)
IV. Optimization Models

**Week 10** (March 26): Guest Lecture, Jonathan Kaplan Economic Research Service, USDA. *Extended paper abstracts and bibliographies due.* Required readings:

Chuvieco (1993)

Oglethorpe, and O'Callaghan (1995)

**Week 11** (April 2): *We will also start MAS models this week.* Required readings:

Angelsen (1999)

Carpentier et al. (2000)

Parker, Manson et al. (forthcoming) (not for student presentation)

Saunders (1997)

V. Multi-Agent System Models

**Week 12** (April 09) *(We will also start integrated models this week)* Required Readings:

Parker and Meretsky (forthcoming)

Engelen (forthcoming)

Pijanowski (2002)

http://www.msu.edu/~pijanows/ceus.pdf

Evaluating LUCC model performance

**Week 13** (April 16) Dr. Parker will be out of town. Class will meet without me to discuss this topic. Required Readings:

Turner, Costanza, and Sklar (1989)

Oreskes et al. (1994)

Pontius (2000)

Pontius and Schneider (2001)

VI. Integrated Models

**Week 14** (April 23) *Final student papers due* Required Readings:

Verburg, Soepboerg, et al. (2002)
Landis and Zhang (1998, Part 2)

Wang and Zhang (2001)

Strengers et al. (forthcoming)

VII. Model Comparisons, Open Questions and Student Paper Presentations

Week 15 (April 30)

Week 16 (May 7)

Bibliography of Required and Supplemental Readings

VIII. Introduction: Issues in Land-Use Change modeling and Drivers of LUC


Statistical Models


http://www.sciencedirect.com/science?_ob=GatewayURL&method=citationSearch&uoikey=B6T3V-472BJ99-1&_origin=EMFR&version=1&md5=0f662f5b4804689cf07bc95d4f64b. Required


http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T3Y-433P6Y4-H&user=10&coverDate=06%2F30%2F2001&rdoc=3&fmt=summary&origin= browse&src=23toc%23234959%2323001%2323999149998%232351240&cdi=45959&sort=d&docanchor=&acct=C000050221&version=1&urlVersion=0&user id=10&md5=10a7d414c997defce9e974c710189401. Required


http://www.sciencedirect.com/science?_ob=GatewayURL&method=citationSearch&uoikey=B6T3V-47285H2-1&_origin=EMFR&version=1&md5=7a3b584d4eb6e4629beac4bc3ea0116. Required


**Markov and Cellular Automata Models**


Optimization Models


Carpentier, C. L., S. A. Vosti, and J. Witcover. 2000. Intensified production systems on western Brazilian Amazon settlement farms: could they save the forest? *Agriculture, Ecosystems and Environment* 82, 1-3: 73-88. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T3Y41P172D-7&_user=10&_coverDate=12%2F31%2F2000&_rdoc=7&_fmt=summary&_orig=browse&_srch=%23toc%234959%232000%23999179998%2323183061&_cdi=4959&_sort=d&_docanchor=&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=e2eda3a8f892482db812ff5e09804118. Required


Multi-Agent System Models


Integrated Models


Evaluating LUCG Model Performance


