

AAE 763: Spatial Modeling in Resource Economics
University of Wisconsin-Madison
Department of Agricultural and Applied Economics

Fall 2007

Instructor: David Lewis

Time: 9:30 – 10:45 am (MW); B30 Taylor Hall

Office Hours: M 4:00-5:00; T 3:30-4:45; W 12:30-1:30

Prerequisites: Graduate level microeconomics and econometrics.

Course Website: www.aae.wisc.edu/lewis/763

Course Objectives: This course has two objectives: 1) explore theoretical approaches to modeling the spatial aspects of economic problems, and 2) develop empirical techniques to analyze spatial problems.

Course Description: While traditional coursework in natural resource economics focuses on the temporal aspects of resource use, the goal of this course is to explore the spatial aspects. In a recent issue of the *Journal of Environmental Economics and Management*, the incoming editor argues that the profession should reorient itself towards analyzing the spatial aspects of environmental and resource problems. A perusal of the current literature confirms the increasing importance of spatial research questions in resource economics.

The course will be divided into four major sections: 1) interface of environmental and urban economics, 2) applications of spatial sorting, 3) natural resource management, and 4) economics of managing ecosystems.

Since there is no unifying methodology to analyze spatial problems (e.g. optimal control theory for temporal problems), this course will be question-based rather than methods-based. In other words, we will ask specific questions about the spatial aspects of resource use and then review relevant methods used in the literature to answer those questions. Some issues that we'll consider include:

- Landscape amenities, development, and urban sprawl.
- Sorting and the valuation of non-marginal changes in environmental quality.
- Marine reserves and fisheries management.
- Timber harvesting and forest conservation.
- Tropical deforestation.
- Conservation targeting.
- Integration of economics and ecology.
- Landscape conservation.
- Spatial econometrics.

Evaluation: Students will also be evaluated based on the following:

- 20%: Class participation: all students will be expected to do the required readings before class and to participate in discussions.
- 20%: An in-class presentation in which each student will be required to select a paper from the reading list (or an alternative paper covering spatial modeling) and lead one class session.
- 20%: Homework exercises (approx. 4) which focus on i) theory, ii) econometric analysis of simulated data, and iii) research ideas of the student's choice. Econometrics may be done in a package of your choosing, though I strongly suggest writing your own code in a package such as Matlab or Gauss (I know Matlab but not Gauss). The research ideas will require a 1-2 page statement regarding a research idea of your choice related to the themes covered in class.
- 40%: A paper (15-20 pages) in which the student can choose one of the options below:
 1. A research paper in which the student will be responsible for identifying and motivating an original research question. The student can then specifically choose one of two options:
 - Setup and analyze a simple theoretical model to address the question and explain the insights derived from the model.
 - Estimate and test a spatial econometric model on a dataset of the student's choosing.

OR

2. A paper in which the student will be responsible for developing an *economic* critique of a public policy issue which is motivated by spatial concerns. An example would be a critique of Wisconsin's recent Smart Growth law, which is related to urban growth and regional planning. The student choosing this option would be responsible for researching all aspects of the policy-in-question, such as its motivation, its goals, and tools of implementation. The student will then be responsible for applying 'state-of-the-art' economics knowledge to critique the policy and provide recommendations for future research needs.

AAE 763: Schedule and reading List

PDF versions of most papers will be available at course website.

Note: The reading list below is preliminary and I encourage students to suggest alternative papers which may be related to their research.

- Interface of Urban and Environmental Economics: Open-Space and Land Development
 - Option Value and Sprawl:
 - D. E. Mills, 1981. "Growth, Speculation and Sprawl in a Monocentric City." *Journal of Urban Economics*, 10: 201-26.
 - Amenities, open-space, and residential development:
 - Bockstael, N.E. 1996. "Modeling Economics and Ecology: The Importance of a Spatial Perspective." *American Journal of Agricultural Economics* 78:1168-1180.
 - Wu, J. and A.J. Plantinga. 2003. "Open Space Policies and Urban Spatial Structure." *Journal of Environmental Economics and Management* 46(2): 288-309.
 - Irwin, E.G. 2002. "The Effects of Open-Space on Residential Property Values." *Land Economics*, 78(4): 465-480.
 - Irwin, E. and N.E. Bockstael. 2002. "Interacting Agents, Spatial Externalities and the Evolution of Residential Land Use Patterns." *Journal of Economic Geography*, 2: 331-54.
- Additional Readings (not covered in class)
- Brueckner, J. K., T. Jacques-Francois, Y. Zenou, "Why Is Central Paris Rich and Downtown Detroit Poor? An Amenity-Based Theory," *European Economic Review*, 43 (1999), 91-107.
 - Anas, A., R. Arnott, K. A. Small, "Urban Spatial Structure," *Journal of Economic Literature*, 36 (1998), 1426-64.
 - Turner, M.A. 2005. "Landscape Preferences and Patterns of Residential Development." *Journal of Urban Economics*, 57(1): 19-54.
 - Wu, JunJie. 2006. "Environmental Amenities, Urban Sprawl, and Community Characteristics." *Journal of Environmental Economics and Management*, 52: 527-547.
 - Carrion-Flores, C., and E.G. Irwin. 2004. "Determinants of Residential Land-Use Conversion and Sprawl at the Rural-Urban Fringe." *American Journal of Agricultural Economics* 86(4): 889-904.
 - Spalatro, F., and B. Provencher. 2001. "An Analysis of Minimum Frontage Zoning to Preserve Lakefront Amenities." *Land Economics*, 77(4): 469-481.
 - Newburn, D.A., and P. Berck. 2006. "Modeling Suburban and Rural-Residential Development Beyond the Urban Fringe." *Land Economics*, 82(4): 481-499.

- Applications of Spatial Sorting
 - Foundations of Sorting:
 - Tiebout, C.M. 1956. "A Pure Theory of Local Expenditures." *Journal of Political Economy*, 64: 416-424.
 - Non-Market Valuation:
 - Sieg, H., Smith, V.K., Banzhaf, S., and R. Walsh. 2004. "Estimating the General Equilibrium Benefits of Large Changes in Spatially Delineated Public Goods." *International Economic Review*, 45: 1047-1077.
 - Timmins, C., and J. Murdock. 2007. "A Revealed Preference Approach to the Measurement of Congestion in Travel Cost Models." *Journal of Environmental Economics and Management*, 53: 230-249.
 - Timmins, C. 2007. "If You Can't Take the Heat, Get Out of the Cerrado... Recovering the Equilibrium Amenity Cost of Non-Marginal Climate Change in Brazil." *Journal of Regional Science*, 47(1): 1-25.
 - Other Applications:
 - Walsh, R. 2007. "Endogenous Open-Space Amenities in a Locational Equilibrium." *Journal of Urban Economics*, 61: 319-344.
 - Banzhaf, H.S., and R. Walsh. 2005. "Do People Vote with Their Feet? An Empirical Test of Environmental Gentrification." *Resources for the Future* Discussion Paper 06-10.
- Additional Readings (not covered in class)
 - Bayer, P. and C. Timmins. 2007. "Estimating Equilibrium Models of Sorting Across Locations." *Economic Journal*, 117(518): 353-374.
 - Murdock, J. 2006. "Handling Unobserved Site Characteristics in Random Utility Models of Recreation Demand." *Journal of Environmental Economics and Management*, 51: 1-25.
- Natural resource management
 - Fisheries Management:
 - Sanchirico, J.N., and J.E. Wilen. 1999. "Bioeconomics of Spatial Exploitation in a Patchy Environment." *Journal of Environmental Economics and Management* 37,129-150.
 - Smith, M.D., and J.E. Wilen. 2003. "Economic Impacts of Marine Reserves: the Importance of Spatial Behavior." *Journal of Environmental Economics and Management*, 46(2): 183-206.
 - Additional Readings (not covered in class)
 - Costello, C.J. and S. Polasky. 2005. "Spatial Bioeconomics Under Uncertainty." Working Paper, University of California, Santa Barbara.
 - Sanchirico, J. N. and J. E. Wilen. 2005. "Optimal spatial management of renewable resources: matching policy scope to ecosystem scale." *Journal of Environmental Economics and Management* 50: 23-46.
 - Forests and Forest Conservation:
 - Swallow, S.K., and D.N. Wear. 1993. "Spatial Interactions in Multiple-Use Forestry and Substitution and Wealth Effects for the Single Stand." *Journal of Environmental Economics and Management*, 25: 103-120.

- Chomitz, K.M., and D.A. Gray. 1996. "Roads, Land Use, and Deforestation: A Spatial Model Applied to Belize." *The World Bank Economic Review*, 10(3): 487-512.
- Alix-Garcia, J. 2007. "A Spatial Model of Common Property Deforestation." *Journal of Environmental Economics and Management*, 53(2): 141-157.

Additional Readings (not covered in class)

- Lewis, D.J., and A.J. Plantinga. 2007. "Policies for Habitat Fragmentation: Combining Econometrics with GIS-Based Landscape Simulations." *Land Economics*, 83(2): 109-127.
- Swallow, S.K., Talukdar, P., and D.N. Wear. 1997. "Spatial and Temporal Specialization in Forest Ecosystem Management under Sole Ownership." *American Journal of Agricultural Economics*, 79:311-326.
- Albers, H. J. 1996. "Modeling Ecological Constraints on Tropical Forest Management: Spatial Interdependence, Irreversibility, and Uncertainty." *Journal of Environmental Economics and Management* 30: 73-94.
- Cropper, M., J. Puri, and C. Griffiths. 2001. "Predicting the Location of Deforestation: The Role of Roads and Protected Areas in North Thailand." *Land Economics* 77(2): 172-186.
- Nelson, G.C. and D. Hellerstein. 1997. "Do Roads Cause Deforestation? Using Satellite Images in Econometric Analysis of Land Use." *American Journal of Agricultural Economics* 79: 80-88.
- Nelson, G.C., Harris, V., and S.W. Stone. 2001. "Deforestation, Land Use, and Property Rights: Empirical Evidence from Darien, Panama." *Land Economics* 77(2): 187-205.

➤ Conservation Targeting:

- Wu, J. and W.G. Boggess. 1999. "The Optimal Allocation of Conservation Funds." *Journal of Environmental Economics and Management*, 38: 302-321.
- Watanabe, M., Adams, R.M., and J.Wu. 2006. "Economics of Environmental Management in a Spatially Heterogeneous River Basin." *American Journal of Agricultural Economics*, 88(3): 617-631.

Additional Readings (not covered in class)

- Wu, J., Adams, R.M., and W.G. Boggess. 2000. "Cumulative Effects and Optimal Targeting of Conservation Efforts: Steelhead Trout Habitat Enhancement in Oregon." *American Journal of Agricultural Economics*, 82: 400-413.

• Economics of ecosystem management

➤ Economics and Ecology:

- Tillman, D., Polasky, S., and C. Lehman. 2005. "Diversity, Productivity and Temporal Stability in the Economics of Humans and Nature." *Journal of Environmental Economics and Management*, 49: 405-426.

- Carpenter, S.R., Ludwig, D., and W.A. Brock. 1999. "Management of Eutrophication for Lakes Subject to Irreversible Change." *Ecological Applications*, 9(3): 751-771.

Additional Readings (not covered in class)

- Armsworth, P.R., B.E. Kendall, and F.W. Davis. 2004. "An Introduction to Biodiversity Concepts for Environmental Economists." *Resource and Energy Economics* 26: 115-136.
 - Peterson, G.D., Carpenter, S.R., and W.A. Brock. 2003. "Uncertainty and the Management of Multistate Ecosystems: An Apparently Rational Route to Collapse." *Ecology*, 84(6): 1403-1410.
 - Carpenter, S. R. and W. A. Brock. 2004. "Spatial complexity, resilience and policy diversity: fishing on lake-rich landscapes." *Ecology and Society* 9(1): 8. [online] URL: <http://www.ecologyandsociety.org/vol9/iss1/art8/>.
- Landscape Conservation with full landscape control:
- Nalle, D.J., Montgomery, C.A., Arthur, J.L., Polasky, S., and N.H. Shumaker. 2004. "Modeling Joint Production of Wildlife and Timber." *Journal of Environmental Economics and Management*, 48(3): 997-1017.
 - Polasky, S., E. Nelson, J. Camm, B. Csuti, P. Fackler, E. Lonsdorf, D. White, J. Arthur, B. Garber-Yonts, R. Haight, J. Kagan, C. Montgomery, A. Starfield, C. Tobalske. 2007. "Where to put things? Spatial land management to sustain biodiversity and economic production." Working Paper, University of Minnesota
- Landscape Conservation with partial landscape control:
- Lewis, D.J., Plantinga, A.J. and J. Wu. 2007. "Targeting Incentives to Reduce Habitat Fragmentation." Working Paper, University of Wisconsin.
 - Nelson, E., Polasky, S., Lewis, D.J., Plantinga, A.J., Lonsdorf, E., White, D., Bael, D., and J. Lawler. 2007. "Efficiency of Incentives to Provide Ecosystem Services." Working Paper.