

GIS in U.S. Urban Studies and Planning Education

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CalGIS Annual Meeting

Santa Barbara, California April, 2006

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This paper was assisted by NSF DUE Grant 0228878 “Space, Culture, and Urban Policy.” Contents of the paper are the responsibility of the author and do not necessarily reflect the view of the National Science Foundation.

The author gratefully acknowledges the assistance of Erika Lew, San Francisco State University B.A. candidate in Urban Studies who assisted in the preparation of this paper.

For further information visit the NSF “Space, Culture, and Urban Policy” website at <http://bss.sfsu.edu/nsfgis/index.htm> or contact Richard LeGates dlegates@sfsu.edu

Introduction

The use of GIS in social science and public policy disciplines has expanded exponentially in recent years. There is worldwide interest in incorporating spatial thinking and the use of GIS into education at every academic level—particularly in academic disciplines and professional fields where spatial understanding and GIS can greatly improve academic understanding, research, and professional practice (National Academy of Science, 2006; Goodchild and Janelle, 2005; LeGates, 2004).

Urban studies and planning are often cited as fields where spatial thinking and GIS should be used. However, there is little information on how GIS has been incorporated into these fields. Nor has there been much serious thinking about alternative models for incorporating GIS sensitive to the variations among urban studies and planning programs. This is particularly important because these programs range from minors in small interdisciplinary urban studies programs at liberal arts colleges with no core urban studies faculty and no faculty knowledgeable about GIS to sophisticated graduate Ph.D. planning programs at major research universities based in professional schools with multiple highly-trained faculty teaching advanced courses drawing on a range of GIS, CAD, remote sensing and related spatial technologies.

This paper describes the variety of types of urban studies and urban planning programs in the United States and different ways GIS has been incorporated into urban studies and planning program curricula. Based on a review of urban studies and planning programs in California and other states, the paper identifies models of how GIS and spatial thinking can be incorporated into different types of urban studies and planning programs. It reviews existing books and other materials useful for defining appropriate GIS content to include in urban studies and urban planning courses at different academic levels and showcases exemplary courses and programs worthy of replication. Finally, the paper describes an instructional module the author has developed titled *Think Globally, Act Regionally* (LeGates, 2005) that is appropriate for undergraduate and graduate urban studies and urban planning students.

Urban Studies and Urban Planning Education

Urban studies and urban planning are closely related academic fields. Many universities have one or more degree programs in both fields, with the same faculty teaching in both urban studies and urban planning programs. For example, The Massachusetts Institute of Technology offers a Masters in City Planning (MCP), a one-year Master of Science (S.M.) degree in planning, an urban studies and planning Ph.D., an undergraduate Bachelor of Science in Planning major, and two different undergraduate minors. Planning students at M.I.T. can draw on the resources of M.I.T.'s Geographic Information Systems Laboratory and participate in GIS-related urban research projects. Research centers devoted to the study of urban phenomena and urban planning and policy issues are usually located in universities that

have one or more urban studies or planning degree programs and are usually staffed by the same faculty who teach in the programs.

Despite overlaps, urban studies education, urban planning education, and urban research are distinct activities calling for distinct strategies for integrating GIS. There is great variety in the size, orientation, financial resources, and institutional setting of urban studies and planning programs. These differences shape the way in which urban studies and planning can realistically incorporate GIS. The types of programs include:

Urban studies programs

Undergraduate

Emphasis or concentration in urban studies within- or among- departments
(usually interdisciplinary programs or programs within
geography departments)

Urban Studies minor

Urban Studies major (B.A. or B.S)

Graduate

Urban Studies M.A.

Urban Studies Ph.D.

Urban planning programs

Undergraduate

Emphasis or concentration in urban planning within- or among-
departments (usually city and regional planning departments)

Urban planning minor

Unaccredited urban planning major (B.A. or B.S)

Accredited urban planning major

Graduate

Urban planning masters (M.C.P.)

Urban planning Ph.D.

The location of programs within a university affects them. Most undergraduate urban studies programs are located within colleges of social science; most graduate urban planning programs within colleges of environmental design. Thus faculty associated with urban studies programs are much less likely to know CAD and other computer-assisted design programs than faculty associated with urban planning programs, but are more likely to include faculty from a variety of social science disciplines with qualitative research skills. The unaccredited undergraduate community planning program located within the college of agricultural and environmental sciences at Alabama Agricultural and Mechanical University—a historically Black university—will be different from M.I.T.'s Ph.D. planning program located within their School of Architecture and Planning. A B.A. degree program in urban studies at St. Olaf college in the small town of Northfield, Minnesota is far differently resourced and should have a different curriculum from the Portland State University's urban studies Ph.D. program. Accordingly a variety of

instructional models are necessary to meet the needs of different urban studies and planning programs.

Urban Studies

Urban studies is an interdisciplinary field that draws primarily on the social science disciplines of economics, political science, geography, and sociology and the professional field of urban planning (LeGates, 2000). The fundamental purpose of urban studies is to help students *understand* cities; not to teach professional skills necessary to plan cities or to design and implement urban policy and programs.

In the United States urban studies is taught at the undergraduate level leading to a B.A. or B.S. degree and at the graduate level leading to a M.A. or M.S. with a title of urban studies or something closely akin such as urban studies and planning, urban affairs, or metropolitan studies. Some programs, such as U.C. San Diego's undergraduate urban studies and planning program combine urban studies and planning.

Most existing urban studies programs were created in the late 1960's and early 1970's and reflect the "urban problems" perspective of the 1960's. There has been a recent resurgence of interest in urban studies, higher student enrollments in existing programs, and the creation of new urban studies programs. The boundaries between urban studies and related programs are fuzzy and there is no agreed-upon inventory of existing urban studies programs.

The Urban Affairs Association (UAA) is a national association concerned with urban studies and urban affairs. The UAA holds an annual conference, publishes a scholarly journal and newsletter, maintains information on member institutions, and otherwise seeks to promote urban studies. There are approximately 76 institutional U.S. members of the UAA¹—mostly universities². The UAA published a directory of programs in urban studies and urban affairs in 1995 (UAA, 1995) that included information on the number of students enrolled in U.S. urban studies and urban affairs programs. Appendix A contains information on U.S. undergraduate urban studies and urban affairs program enrollment at that time. The UAA identified 64 U.S. undergraduate urban studies and urban affairs programs in existence in 1995 with over 2,700 students enrolled: 1,517 in undergraduate programs they characterized as urban studies programs; 1,252 in undergraduate programs they characterized as urban affairs programs. The UAA directory also identified 61 masters and 21 Ph.D. programs in urban studies and urban affairs. In the eleven years since the 1995 directory was published, some urban studies and urban affairs programs have ceased to exist while some new programs have been created. Enrollments in these programs have grown. It is probable that there are more than 125 urban studies/urban affairs programs in the U.S. today with enrollments exceeding 3,000 students.

Urban Planning

Urban planning education is distinct from urban studies education. In the United States urban planning is primarily taught in two-year full-time professional masters programs culminating in a MCP (Masters of City Planning) degree or similarly-titled degree (e.g. Masters of Urban Planning; Masters of City and Regional Planning). Many universities offer emphases and minors in urban planning. Almost all graduate planning masters programs are accredited by the Planning Accreditation Board (PAB). Urban planning programs' core mission is to educate practitioners to serve as professionals in public sector offices such as city planning departments, nonprofit sector organizations such as housing development corporations, and private sector institutions such as real-estate development companies. Accordingly the emphasis in graduate urban planning education is on theoretical knowledge and practical skills to equip professional planners to understand, plan, and manage cities and metropolitan regions.

Most planning programs are graduate professional masters degree programs. There are currently 101 urban planning masters programs accredited by the PAB listed in the Association of Collegiate Schools of Planning (ACSP) *Guide to Graduate and Undergraduate Urban Planning Education 11th edition* (ACSP, 2000).

The PAB has accredited ten undergraduate urban planning programs—all at universities that also have graduate planning programs. The most recent ACSP *Guide to Graduate and Undergraduate Education in Urban Planning* identified seven unaccredited urban planning programs associated with ACSP and the UAA's 1995 directory identified 18 additional unaccredited undergraduate urban planning programs in existence at that time.

In the United States a national accrediting board—the PAB—accredits U.S. (and some foreign) planning programs. A national professional planners' association (the American Planning Association), a key professional journal (*The American Planning Association Journal*), a national association of urban planning educators (The Association of Collegiate Schools of Planning), and a national planning education journal (*The Journal of Planning Education and Research*) all contribute to the vitality of the field of urban planning.

GIS in Urban Studies and Urban Planning Programs

Understanding spatial analysis concepts and being able to perform GIS operations are fundamental skills essential both for *understanding* cities and regions and for *formulating plans and policies for them*—the *raison d'être* for urban studies and urban and regional planning programs. Accordingly a well-thought-out GIS component should be a part of the core curriculum of every urban studies and urban planning program.

The amount of time devoted to GIS and spatial thinking in urban studies and planning programs, the level of sophistication of the material taught, and the complexity of the computer operations students are expected to master must necessarily vary depending upon the academic level and nature of the program. For undergraduate urban studies emphases and concentrations, merely alerting students to the existence of GIS and including a few lectures using Google Earth to illustrate spatial thinking concepts may be as far as GIS and spatial thinking instruction can go. At universities with specialized graduate programs such as The University of Illinois Urbana-Champaign³, some students take a sequence of advanced courses in GIS, other spatial technologies, GIScience, and spatial econometrics related to urban planning that equip them to do highly technical planning.

It is also appropriate for the substantive content of the GIS material taught in urban studies and urban planning programs to vary from university to university. Universities located in states like Florida and Hawaii, which have fragile ecosystems, may place greater emphasis on GIS applications for environmental management. Colleges in inner cities might place greater emphasis on the use of GIS to analyze census data on poverty and race.

Both the level of instruction and the orientation of content may shape choice of a university's GIS and other concepts and operations to teach. For example an undergraduate program emphasizing the use of GIS for demographic analysis might limit instruction to vector GIS because census units are defined as polygons that vector GIS handles well, while a program that stresses environmental analysis might choose to place greater emphasis on raster GIS, which is more appropriate for analysis of continuous variables such as air and water pollution of soil quality.

However, the U.S. urban studies and urban planning program websites examined for this paper indicate that most undergraduate urban studies programs do not expose their students to any GIS or spatial thinking at all and those that do often lack a clear and explicit set of learning objectives. The curriculum materials developed by the National Center for Geographic Information and Analysis (NCGIA, 2000) and the University Consortium for Geographic Information Science (UCGIS, 2003; UCGIS, 2006) do not appear to have had any impact on U.S. urban studies and planning curricula. GIS is now included in most graduate planning curricula, but the extent and nature of what is taught varies widely. Most graduate planning programs have a required or elective introductory course in GIS applications in planning and there are strong and sophisticated multi-course GIS components in some major

graduate planning programs. Some graduate urban planning programs still do not require their graduates to study any GIS or spatial thinking.

GIS in U.S. Urban Studies Programs

In most U.S. urban studies programs students currently receive no education in spatial analysis or GIS. In some programs—particularly programs associated with urban planning or geography departments—GIS has been introduced into the curriculum either as a part of students' required education in computer applications, research methods, data analysis, visual communication, design or other courses or as an elective course in the urban studies major. Sometimes urban studies programs rely on GIS courses taught in geography, GIS, GIScience, or other departments to teach GIS to urban studies majors—almost always as an elective, rather than a required part of the major.

For this study, curricula of all California urban studies programs and selected urban studies programs in other states were examined. Table 1 presents information on how GIS is taught in California urban studies programs.

Table 1: California Urban Studies Programs

School	Degree	ACSP	UAA	Comment
U.C. Berkeley	B.A.	x	x	Landscape Architecture GIS course as elective.
CSU Northridge	B.A.	x		GIS not mentioned in curriculum.
San Diego State University	B.A.	x		Interdisciplinary major. Geography electives may include a GIS course.
San Francisco State University	B.A.			GIS modules included in required two-step Research Methods and Data Analysis sequence.
San Jose State University	Minor	x		No GIS required. CAD course is one option to satisfy core requirements. Graduate planning course electives.
Stanford University	B.A.			Geological and Environmental Sciences GIS and remote sensing course electives.

Source: Urban Affairs Association website and Departmental websites.

Table 1 and the two following tables should be read with caution. The material in these tables was taken from department websites which do not always accurately reflect a program's curriculum and the author's interpretation of the material may not reflect arrangements at the university that are not apparent in formal descriptions of the programs.

The six urban studies programs in California are all undergraduate programs. Five offer a B.A. degree; one a minor. None of the six California urban studies programs has an urban studies GIS course or requires majors to complete a GIS course in another department. Only San Francisco State University requires all majors to learn some GIS through instructional modules in required research methods and data analysis courses.

U.C. San Diego is the only California program that combines urban studies and planning. Their degree—titled B.A. in urban studies and planning—is included in table 3. This program offers a GIS elective course as one of five options in the program’s research methods sequence. Students who elect this option may also take a community planning lab that allows them to apply the GIS skills from the introductory course. The U.C. San Diego urban studies and planning program is discussed further in the section on exemplary programs below.

Three patterns merit further discussion.

GIS as a required course within the major. The most satisfactory way to incorporate GIS into an undergraduate urban studies curricula is for a qualified faculty member based in the program to teach a *required* GIS course for majors using course materials at an appropriate level and with substantive subject matter related to urban studies⁴. Only a few undergraduate urban studies or urban planning programs require a GIS course⁵. Requiring an introductory course as part of the major is superior to having it as an elective or relying on a GIS course from another department. If an introductory GIS course is an elective, students who choose not to take it will get no exposure to GIS. If a program borrows a course from Geography, Landscape Architecture, Forestry, Earth Sciences, Environmental Studies, GIS, or some other department or program where GIS is taught, the substantive GIS instruction may be appropriate, but unless students see the application of the material to the issues in their major, such a course is likely to be less effective than one specifically tailored to the major.

GIS as a module within computer applications, research methods, or data analysis courses. Almost all urban studies programs have one or more required core computer applications, quantitative reasoning, or research methods courses—with titles such as “Computer applications in Urban Studies”, “Research Methods in Urban Studies”, “Statistics for Urban Studies”, or “Planning Analysis” These courses may introduce students to a variety of computer software, social science research methods, models, and statistics material. A second approach to introducing undergraduate urban studies students to GIS and spatial thinking is as a module within one of these required basic courses. In that way all students are introduced to GIS with at least a portion of a course devoted to learning spatial thinking and GIS concepts. That is the approach at San Francisco State University, where all urban studies majors are required to take a two-course sequence in research methods and data analysis that includes GIS modules when taught by the regular instructors. The modules used at SFSU are described below and in greater detail at the project website at: <http://bss.sfsu.edu/nsfgis/index.htm>.

Introducing GIS as a module within a computer applications, research methods, or data analysis course requires a faculty member in the urban studies program (or borrowed from another department) to teach the course. Few undergraduate and graduate urban studies and planning programs teach GIS in their computer applications, research methods, or data analysis courses. Even at SFSU, GIS is not covered when the required research methods and data analysis course is taught by a lecturer unfamiliar with GIS.

Using GIS courses in other departments. Most urban studies programs are located within colleges of social science that include a geography department. At universities where urban studies programs exist GIS may also be taught in some other department such as GIS/GIScience, Landscape Architecture, Environmental Studies, Library Science, or Forestry. Some urban studies programs use one or more GIS courses from other departments for their majors—usually as elective(s). For example Elmhurst College permits their majors to take one GIS and one remote sensing course taught in the Elmhurst College geography department as electives. For urban studies programs that do not have faculty with GIS competence—particularly small liberal arts colleges—this may be the only alternative. It may be a cost-effective way to offer more than one GIS course when there is not enough student demand to support multiple courses. One major problem with this approach is that there may be a disconnect between GIS content and core substantive concerns of the major. Allowing majors to choose from among GIS and many other courses as electives may produce urban studies graduates with very different skills sets. For example at the University of Connecticut in Storrs, students in the urban and community studies major may satisfy elective requirements by taking “Introduction to Geographic Information Systems” and “Geographical Analysis of Urban Social Issues” or alternatively with “Hip-Hop, Politics and Youth Culture in America” and “City Life.” Brown University offers similar flexibility.⁶ This degree of latitude within urban studies may leave some students who complete an undergraduate urban studies degree poorly equipped for graduate school or work in urban planning.

Re-tooling existing faculty competence. Another alternative is for faculty who were never educated in GIS and spatial thinking or who have not kept up with the rapidly evolving field to acquire enough knowledge to teach GIS at a level appropriate to their institutional setting. This is not realistic for empowering faculty to create graduate-level GIS courses, but supporting motivated faculty who have analytical and computer skills and are willing to invest time in to learn GIS and to create new introductory GIS courses may be sufficient for introducing GIS into undergraduate courses. Two important institutions provide this kind of faculty education: the Spatial Perspectives in Analysis for Curriculum Enhancement (SPACE) project at the Center for Spatially Integrated Social Science (CSISS) at U.C. Santa Barbara and the Latitude Project at the National Institute for Technology in Liberal Education (NITLE).⁷ The SPACE program conducts summer workshops to help social science faculty at any U.S. university to learn GIS and spatial thinking; NITLE conducts similar workshops for faculty from member small liberal arts colleges. Similar programs exist in the UK and Australia.⁸

GIS Education in Urban Planning Programs

GIS should be more fully incorporated into urban planning programs—which emphasize applied skills—than in urban studies programs, particularly at the graduate level. Tables 2 and 3 present information on how GIS is taught in California's nine graduate and five undergraduate planning programs. They suggest that GIS education is somewhat stronger in undergraduate urban planning programs than undergraduate urban studies programs, and considerably strong in graduate planning programs.

Table 2: California Masters Programs in Urban Planning

School	Program	Degree	ACSP	UAA	Comment
California Polytechnic State University, San Luis Obispo	City and Regional Planning	MCP	x		GIS courses are offered through the Landscape Architecture department.
California State Polytechnic University, Pomona	Urban and Regional Planning	MA	x		GIS applications elective.
CSU, Chico	Rural and Town Planning Option in Geography	MA	x		No GIS courses listed.
San Diego State University	City Planning	MCP	x	x	Geography GIS elective.
	City Planning emphasis in Public Administration.	MPA	x	x	Geography GIS elective.
San Jose State University	Urban and Regional Planning	MCP	x		Seven-course “Applications of Technology in Planning” specialization. Includes four GIS applications courses offered by the Planning and Geography departments.
U.C. Berkeley	City and Regional Planning	MCP	x		Five-course “Field in GIS and Spatial Analysis.” Includes three GIS applications courses offered by City Planning and Landscape Architecture departments.
U.C. Irvine	Urban and Regional Planning	MURP	x	x	Introductory GIS planning applications course.
U.C. Los Angeles	Urban Planning	MA	x	x	Two GIS electives: introductory course and advanced applications course.
University of Southern California	Public Policy, Management, and Planning	MA	x		No GIS required. Courses in GIS minor may be taken as electives.

Source: ACSP Guide to Graduate and Undergraduate Education in Urban Planning and departmental websites

In addition to the masters programs in urban planning there are five undergraduate planning programs in California that offer a B.A. or B.S. degree and two that offer a minor. Table 3 presents information on how GIS is taught in these programs.

Table 3: GIS in California Undergraduate Urban Planning Programs

School	Program	Degree	ACSP	UAA	Comment
California Polytechnic State University, San Luis Obispo	City and Regional Planning	B.S.	x		Landscape Architecture GIS electives.
California State Polytechnic University, Pomona	Urban and Regional Planning	B.S.	x		GIS not in curriculum. GIS elective available.
San Diego State University	Public Administration with City Planning emphasis	B.A.	x	x	Geography GIS elective.
U.C. Berkeley	City Planning Minor	Minor	x	x	Landscape Architecture GIS elective.
U.C. San Diego	Urban Studies and Planning	B.A.			Two GIS electives: introductory course and research lab focusing on the local region.
University of Southern California	Public Policy, Management, and Planning	B.S.	x		No GIS required. Courses in GIS minor may be taken as electives.
	Minor in Urban Policy and Planning	Minor	x		No GIS required. Courses in GIS minor may be taken as electives

Source: ACSP Guide to Graduate and Undergraduate Education in Urban Planning and departmental websites

Models for teaching GIS in graduate planning programs in California parallel those for the undergraduate programs, but the teaching is more pervasive, deeper, and offered in a greater variety of ways.

GIS courses within planning majors. Virtually every graduate urban planning program now provides for students to learn some GIS, either through required or elective GIS course(s) within the major or offered by other departments that planning students can take for credit in the major. Stronger programs offer beginning and advanced GIS courses and give students the option to supplement their GIS education through courses in other departments. A few graduate planning programs have GIS practicum courses where students can practice their GIS skills on a specific urban planning problem. Studio or practicum courses are common in the latter part of graduate planning curricula, so planning students are often able to integrate GIS with other applied skills even if they are not taking a studio or practicum course

devoted exclusively to GIS. For example at Cal Poly San Luis Obispo all MCRP students learn GIS in a required “GIS and Data Visualization” course⁹ early in their program. Later, in laboratory courses such as “Community Planning Studio,” the students use their GIS together with urban design, economic analysis, conflict resolution, and other skills learned in the program to work on a real-world problem.

GIS courses in other departments. Urban planning programs are usually lodged within colleges of environmental design that include other graduate professional programs in architecture, landscape architecture, and related fields such as construction management. GIS and computer assisted design (CAD) courses taught in these other programs within the college may be available to planning majors. For example at U.C. Berkeley, in addition to an introductory GIS course¹⁰ and two advanced GIS courses¹¹ taught within the department of city and regional planning, graduate planning students may take GIS-related coursework in the landscape architecture program within the college of environmental design. At Cal Poly San Luis Obispo, all students can supplement the GIS they learn in a required core “Data Visualization and GIS” course with more advanced GIS training in courses offered in the college of Architecture and Urban Planning's Landscape Architecture program.

Approximately 1350 faculty teach at the 101 accredited urban planning programs in the United States (ACSP, 2000). These faculty self-identify their areas of expertise. Thirty-six areas are listed, including GIS, computer applications, and quantitative analysis. One hundred fifty-one of these members self-identified as having a specialization in GIS, 218 as having a specialization in quantitative methods, and 167 in computer applications. While many faculty claim a specialty in more than one of these three specializations, more than one third of planning faculty who self-identify as having expertise in computer applications or quantitative methods do not consider themselves to have expertise in GIS¹². It is probable that older faculty—well trained in statistics and computerized statistical packages before GIS was widely used—continue to teach quantitative methods and computer applications courses that do not include GIS, while quantitatively-oriented younger planning faculty conversant in GIS as well as other computer applications and quantitative methods teach GIS courses and courses that combine spatial and aspatial methods and technologies. Appendix E is a list of planning faculty in one or more of these specialty areas.

Resources for teaching GIS in urban studies and urban planning programs

Given the weak incorporation of GIS and spatial thinking into undergraduate urban studies and planning curricula and the uneven incorporation of GIS into the great variety of graduate planning programs, a review of materials for teaching GIS and how they are and might be used at different levels of instruction is in order.

Two national consortia have developed inventories of concepts that they believe should be taught in GIS or GIScience education: NCGIA based at U.C. Santa Barbara and the University Consortium for GIS (UCGIS) based in Washington, D.C. NCGIA developed a core curriculum for GIS in the 1990s (NCGIA, 2000). UCGIS produced a draft set of GIS concepts in 2003—titled the *Strawman Report* (UCGIS, 2003)—and have produced a draft document summarizing the “body of knowledge” in GIS that they believe should be taught in GIS and GIScience undergraduate and graduate degree programs (UCGIS, 2006). Both organizations have sought to systematize concepts in the rapidly-evolving world of GIS and GIScience appropriate for students completing a full undergraduate or graduate major in GIS or GIScience. Their recommendations are more extensive and include more advanced GIS instruction than is practical for most urban planning students. They extend to GIScience, which is broadly defined to include quite technical material that most urban studies and planning students need not master to use GIS and related technologies effectively. Accordingly it is only realistic for most students in urban studies or urban planning, who study GIS as only a part of their education, to master a set of the concepts proposed by the NCGIA and UCGIS appropriate to urban studies and planning. Depending on the level and nature of the program the set of concepts may be more or less extensive. The important work of these expert bodies should serve as a guide to professors of urban studies and urban planning at all levels, but particularly for the largest, best-funded graduate-degree-granting urban planning programs.

The National Academy of Science (NAS) has just completed a five-year project to define how GIS and spatial thinking may best be incorporated in K-12 education (National Academy of Science, 2006). Since this report is aimed at K-12 educators, the NAS recommendations call for less advanced concepts than appropriate even for undergraduate urban studies education. Nonetheless, this thoughtful, lengthy, and well-funded project can also serve as a useful guide to what GIS and spatial thinking concepts should be included in urban studies and planning education, particularly at the undergraduate level.

Four recent texts teach GIS using urban studies and planning material (Greene and Pick, 2005; Huxhold, Fowler, and Paar, 2004; LeGates, 2005, and Pamuk, 2006). All four texts include exercises and data to teach basic GIS using ArcGIS. The books are all appropriate for introductory GIS courses in urban studies and planning, but are geared toward different audiences.

Richard P. Greene and James B. Pick's *Exploring the Urban Community* (New York: Prentice-Hall, 2005) was written for use in undergraduate urban geography courses. It explores classic and contemporary issues in urban geography that are very relevant to urban studies and planning using GIS. The level is appropriate for upper-division undergraduates or beginning graduate students. *Exploring the Urban Community* works best for its intended audience of urban geography students, very well for courses introducing GIS in urban studies programs, and somewhat less well for introductory GIS courses in planning programs. It is

designed to be accessible to undergraduate students with no GIS background, but will work best if students already know some GIS. The material is sophisticated enough to serve in introductory graduate planning GIS courses.

William E., Huxhold, Brian M. Fowler, and Brian Paar's, *ArcGIS and the Digital City*. (Redlands: ESRI Press, 2004) teaches practical skills that students who go on to work in city planning departments can put to immediate use, such as converting CAD drawings to GIS, parcel mapping, and linking attribute data to shapefiles. The content and orientation of this book is geared towards urban planning; *ArcGIS and the Digital City* is not appropriate for introducing urban studies students to GIS.

Ayse Pamuk's *Mapping Global Cities* (Redlands: ESRI Press, forthcoming 2006) is intended for use as a module in undergraduate urban studies data analysis courses. It has a global focus, including examples from the author's own work in urban planning and policy analysis, and is appropriate for undergraduate urban studies and planning courses.

The fourth book, the author's *Think Globally, Act Regionally* (Redlands: ESRI Press, 2005) was designed for use in undergraduate research methods courses in urban studies and other social sciences. It works particularly well as a four-to-six week module in beginning undergraduate or graduate urban studies and urban planning courses in computer applications, research methods, and data analysis. *Think Globally, Act Regionally* is described in greater detail below.

Four leading figures in the development of GIS and GIScience education—Michael Goodchild, Paul Longley, David J. Maguire, and David W. Rhind—have co-authored a widely-used core introductory text for GIS and GIScience programs: *Geographic Information Systems: Principles, Techniques, Management and Applications 2nd ed.* (New York: John Wiley & Sons, 2005). This is a sophisticated and up-to-date text appropriate for use as a core or supplementary text in graduate-level urban planning GIS courses.

The Environmental Systems Research Institute (ESRI) is the leading GIS software company. Currently, ESRI's ArcGIS is the software of choice in virtually all urban studies and planning programs. ESRI Press publishes books related to GIS, including those by Pamuk, LeGates, and Huxhold et. al., described above. Two ESRI guides to spatial analysis by Andy Mitchell are appropriate companion texts for introductory GIS courses in urban studies and planning (Mitchell, 1999) and advanced courses (Mitchell, 2005). ESRI also publishes how-to books that teach GIS operations using their ArcGIS software—notably *Getting to Know ArcGIS 2nd ed* (Ormsby, Napoleon, Burke, Groessl, and Feaster, 2004) and *GIS Tutorial: Workbook for ArcView 9* (Gorr and Kurland, 2005).

There are a number of accessible introductory GIS texts (Clarke, 2002, Bolstad, 2002, Mitchell, 2001) and others¹³ suitable for teaching GIS in urban studies and undergraduate urban planning programs.

Table 4 summarizes ways these materials might be used in undergraduate urban studies and urban planning programs. The information in these tables is not meant to suggest one best set of course materials, but to illustrate how conceptual material, academic books focused on GIS and urban issues, GIS texts, how-to books, and ESRI virtual campus courses might be used at different levels of instruction.

Table 4: Materials for Introducing GIS to Undergraduate Urban Studies and Urban Planning Programs

Urban Studies undergraduate education	
Emphasis or concentration	Lectures/labs drawing on Greene and Pick or LeGates in intro or methods course.
Minor	Greene and Pick or LeGates modules as part of required methods course.
Major	Greene and Pick or LeGates modules and Mitchell, <i>Guide to Spatial Analysis Volume 1</i> . Perhaps Clarke, Bolstad, Chrisman, DeMers Perhaps ESRI how-to books or virtual campus courses.
Urban Planning undergraduate education	
Emphasis or concentration	Lectures/labs drawing on LeGates or Pamuk in intro or methods course.
Minor	LeGates or Pamuk modules as part of methods requirement.
Major	LeGates or Pamuk Mitchell, <i>Guide to Spatial Analysis Volume 1</i> . Perhaps Clarke, Bolstad, Chrisman, DeMers Perhaps ESRI how-to books or virtual campus courses.

Table 5 summarizes ways these materials might be used in graduate urban studies and urban planning programs.

Table 5: Materials for Introducing GIS to Graduate Urban Studies and Urban Planning Programs

Graduate Urban Studies Programs	
Emphasis or concentration	LeGates or Greene and Pick as part of methods requirement.
Minor	LeGates or Greene and Pick as part of methods requirement.
Major	LeGates or Pamuk and Mitchell, <i>Guide to Spatial Analysis Volume 1</i> in intro GIS course. Perhaps Clarke, Bolstad, Chrisman, DeMers Perhaps ESRI how-to or virtual campus courses.
Graduate Urban Planning Programs	
Emphasis or concentration	Lectures/labs drawing on LeGates and Mitchell, <i>Guide to Spatial Analysis Volume 1</i> in intro or methods course.
Minor	LeGates and Mitchell, <i>Guide to Spatial Analysis Volume 1</i> as part of methods requirement.
Major	LeGates and Mitchell, <i>Guide to Spatial Analysis Volume 1</i> as texts in required intro to GIS course. Perhaps Clarke, Bolstad, Chrisman, DeMers Perhaps ESRI how-to or virtual campus courses.
Multi-course GIS in planning specialization	Longley, et. al, Mitchell, <i>Guide to Spatial Analysis Volume 2</i> , and advanced ESRI virtual campus courses as material in advanced GIS course Advanced material in three to eight GIS, remote sensing, other spatial technologies; spatial econometrics; modeling; and related courses. Informed by UCGIS base of knowledge in GIScience.

Exemplary GIS programs in urban studies and planning

In order to identify models of how GIS and spatial thinking can be introduced into urban studies and urban planning courses, the websites of 70 universities with urban studies and urban planning programs were examined¹⁴. Given the large number of such programs and variation in the extent to which programs make information on their programs available on the web, the following examples make no pretension to comprehensiveness. Undoubtedly many additional exemplary programs exist. Following are descriptions of some notable programs.

U.C. San Diego's B.A. in Urban Studies and Planning with two-step GIS electives.

Urban Studies and planning are separate degree programs in most U.S. universities. U.C. San Diego is one of the few universities that offers a combined urban studies and planning B.A. degree. Unlike students in other California undergraduate urban studies and undergraduate urban planning programs—none of which offer GIS courses taught within the department itself—U.C. San Diego students may elect to take an elective GIS course to satisfy their research methods requirement¹⁵. Students who take the GIS course may take a second course which allows them to apply their GIS skills in a community planning lab¹⁶. Further information on San Diego's program is available at <http://usp.ucsd.edu/>.

Clemson University's required 2-step GIS sequence with additional electives.

Clemson University is exemplary of graduate planning programs that require all students to take GIS, integrate the GIS with other planning skills, and provide electives for students to further their expertise. Clemson requires that students complete a two-step year-long course sequence related to quantitative analysis and land use, taught within the department and designed to teach students analysis and communication skills as well as GIS operations and an understanding of how GIS can be used in land use planning¹⁷:

Students in the Clemson program can take up to three additional electives in spatial modeling and remote sensing, all taught within the department.¹⁸ Further information on the Clemson program is available at <http://www.clemson.edu/caah/pla/planning/curriculum.htm>.

University of Illinois Urbana-Champaign Department of City and Regional Planning "Planning Analysis and Information Systems" Concentration.

The University of Illinois Urbana-Champaign is exemplary of a multi-course planning *concentration* in GIS and related technologies. Their "Planning Analysis and Information Systems" concentration exposes students to GIS, planning support systems, hypermedia, video, and mathematical modeling of urban growth and transportation systems. Students who choose this concentration take four key courses—a two step sequence in GIS for planners, advanced modeling in planning, and landscape modeling—and can select from up to eight additional courses from geography, library and information science, and business in topics

such as land resource evaluation, landscape modeling, remote sensing, and advanced spatial analysis. Further information on the University of Illinois program is available at <http://www.urban.uiuc.edu/>.

University of Illinois at Chicago's Great Cities Urban Data Visualization Lab (GCUDV) Seminar Series.

The University of Illinois at Chicago offers a series of seminars that provides students and professionals with little or no prior experience in graphic design practical instruction on how to produce professional maps and data graphics from GIS, CAD, Excel, and other sources. The seminar materials are freely accessible online. The seminar in this series on how to use Adobe Illustrator for urban planning contains five straightforward exercises that teach seminar participants how to:

- Touch up GIS or AutoCAD drawings
- Create graphs and charts
- Draw base maps
- Draw from photographs
- Create presentation boards

Further information on this program is available at <http://www.uic.edu/cuppa/udv/>.

The Think Globally, Act Regionally Approach

The author is the principle investigator for a National Science Foundation project designed to develop instructional modules to teach undergraduate social science students spatial analysis and data visualization. *Think Globally, Act Regionally*, prepared with grant support, was published by ESRI Press in 2005 (LeGates, 2005). Ayse Pamuk, the project co-PI, is writing a second module titled *Mapping Global Cities* scheduled for publication by ESRI Press in 2006 (Pamuk, 2006).

Both modules consist of: (a) a well-illustrated paperback book with many GIS maps and with other material appropriate for a four to six week segment of an upper division undergraduate social science research methods course (LeGates, 2005) or data analysis course (Pamuk, 2006), and (b) GIS data sets to accompany the modules, and (c) additional resources on a website accompanying the modules.¹⁹

Think Globally, Act Regionally provides a global context and then focuses on urban problems at the metropolitan regional level in the United States and the way in which GIS and data visualization can be used to better understand the problems and devise solutions to them. The book is divided into four parts. Each of the first three sections of the book consist of: (a) a chapter introducing a substantive theme undergraduates find interesting (global urbanization impacts, human/environmental conflicts, and social equity). These include maps, but discuss spatial analysis concepts and operations only in passing, (b) one or more chapters on spatial

analysis concepts that use examples related to the theme, and (c) a chapter on data graphics and data visualization related to the theme. The final chapter describes how Metro in Portland, Oregon uses GIS for successful regional planning. The chapters do not describe how to use specific GIS software, but seven accompanying exercises at the end of the book step students through ArcGIS operations to produce maps like those shown in the book.

A CD-Rom with datasets for the exercises is included with the book. Step-by-step exercises to teach software applications are preceded by a specification of learning objectives and a section titled “Your Turn” at the end that asks students to repeat each of the operations they have learned using different data. The culminating project for the module calls for students to apply all they have learned to real data from Metro's Regional Land Information System (RLIS) supplied on the CD-Rom.

Think Globally, Act Regionally and Ayse Pamuk's companion book *Mapping Global Cities* are appropriate for upper division undergraduate urban studies and planning students in research methods and data analysis courses. They are also appropriate for students in introductory GIS programs in graduate urban planning programs.

Conclusion

There is an ongoing revolution in GIS, GIScience, and related technologies for analyzing space and an explosion of knowledge about spatial thinking. These developments are extremely important for urban studies and planning. At the undergraduate level, most U.S. urban studies programs still do not presently teach students any spatial analysis or GIS operations. A few undergraduate urban studies and urban planning programs have incorporated some GIS and spatial thinking into computer application, research methods, data analysis or other courses; others encourage or permit their students to take GIS courses in other departments for credit in the major; and some offer their own GIS elective(s) or—rarely—required GIS course(s).

At the graduate level, GIS instruction has been incorporated into most urban planning program curricula. Most U.S. urban planning programs teach graduate students GIS through methods, analysis, and design courses, electives in the department or in other departments, or a required introductory course on GIS applications in urban planning. A number of urban planning programs have one or more advanced GIS courses or permit their students to take advanced courses in GIS, remote sensing, and related spatial technologies in other departments for urban planning credit. Multi-course specializations in GIS for planning at a few universities allow interested students to get solid education in planning and GIS/GIScience.

There is an abundance of teaching resources available to teach GIS and spatial thinking in urban studies and urban planning programs: the UCGIS base of knowledge and NAS spatial thinking report, introductory GIS and GIScience texts, how-to books that teach GIS applications, ESRI virtual campus courses, and four new books that combine written chapters on GIS applications to urban issues and urban planning and exercises to teach GIS.

As the dissemination of GIS and spatial thinking continues and the software becomes increasingly available and user-friendly, it is inevitable that their role in undergraduate urban studies and urban planning education will be expanded. Graduate planning GIS courses will evolve rapidly in the future, drawing upon new knowledge from the fields of GIS, GIScience, and related fields. It is likely that the more sophisticated programs will incorporate concepts from the University Consortium for GIS “body of knowledge” (UCGIS, 2006) and cutting-edge material on GIScience developed by Michael Goodchild and others (Longley, Goodchild, Maguire, and Rhind, 2005).

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Appendices

- Appendix A. 1995 Undergraduate U.S. Urban Studies and Urban Affairs Program enrollments from the Urban Affairs Association *Directory of Programs in Urban Studies and Urban Affairs* (1995).
- Appendix B. Urban Planning Programs in the Association of Collegiate Schools of Planning *Guide to Graduate and Undergraduate Urban Planning Education, 11th edition* (2000).
- Appendix C. Enrollments in PAB-accredited undergraduate urban planning programs in 1998/1999 from the Association of Collegiate Schools of Planning *Guide to Graduate and Undergraduate Urban Planning Education, 11th edition* (2000).
- Appendix D. Enrollments in unaccredited undergraduate urban planning programs in 1998/1999 from the Association of Collegiate Schools of Planning *Guide to Graduate and Undergraduate Urban Planning Education, 11th edition* (2000).
- Appendix E. Planning faculty with specializations in GIS, computer applications, and/or quantitative methods from the Association of Collegiate Schools of Planning *Guide to Graduate and Undergraduate Urban Planning Education, 11th edition* (2000).
- Appendix F. Urban studies and planning program websites examined for this paper.

Footnotes

- ¹ At the time this paper was written in March, 2006 the UAA member list contained 76 U.S. members and eight foreign members. The UAA was revising the list of institutional members at that time.
- ² Some non-teaching institutions like the Brookings Institution, Urban Institute, and Fannie Mae Foundation are institutional members of the Urban Affairs Association.
- ³ Other universities with strong programs relating urban planning and GIS identified in our (non-comprehensive) web-search include The Massachusetts Institute of Technology, Rutgers, The University of Southern California, and Georgia Tech.
- ⁴ Two new texts are particularly appropriate for a required introductory GIS course for urban studies majors: *Exploring the Urban Community: A GIS Approach* by Richard P. Greene and James B. Pick (New York: Prentiss-Hall, 2005) and *Think Globally, Act Regionally: GIS and Data Visualization for Social Science and Public Policy Research* (Redlands: ESRI Press, 2005) by the author of this paper, Richard LeGates. Andy Mitchell's, *The ESRI Guide to GIS Analysis Volume 1* (Redlands: ESRI Press, 2001) would be an excellent secondary text for such a course.
- ⁵ Our (non-comprehensive) web search identified only one undergraduate urban studies program and two undergraduate urban planning programs that require a GIS course: Jackson State's Urban Studies Program, Rutgers at Camden's Urban Studies and Metropolitan Planning Program, and East Carolina's B.S. in Urban and Regional Planning.
- ⁶ At Brown an urban studies major could opt to take "GIS: A Social Science Perspective" and "GIS and Public Policy" as electives or, alternatively, "Samurai and Merchants, Prostitutes, and Priests: Japanese Urban Culture in the Early Modern Period" and "The Visual Culture of Early Modern Rome."
- ⁷ The CSISS' website is <http://www.csiss.org/>. The Latitude project at NITLE's website is <http://www.nitle.org/index.php/nitle/collaborations/latitude>.
- ⁸ The Spatial Literacy in Teaching (SPLINT) Program is a collaboration between GIS experts at the University of Leicester (lead institution), University College London, and the University of Nottingham to encourage spatial literacy and use of geospatial technologies. A similar Australian program is ARC Research Network in Spatially Integrated Social Science (ARCRNSISS).
- ⁹ CRP 512 "Data Visualization and GIS".
- ¹⁰ CP 204c "Introduction to GIS in City Planning".
- ¹¹ CP 290 "Spatial Analysis and Modeling for Urban and Environmental Planning" and CP 255 "Urban Planning Applications of GIS".
- ¹² 91 faculty of planning schools declared that they had specialties in both GIS and computer applications; 93 specialties in both GIS and quantitative methods, 70 in both computer applications and quantitative methods (but not GIS). Forty-one planning professors felt that they had a specialization in all three areas.
- ¹³ Other introductory GIS texts include Michael N. Demers' *Fundamentals of Geographic Information Systems 2nd ed.* (New York: John Wiley, 2000), Ian Heywood, Sarah Cornelius, and Steve Carver's, *An Introduction to Geographical Information Systems 2nd ed.* (New York: Prentice-Hall, 2002), and Nicholas Chrisman's *Exploring Geographical Information Systems 2nd ed* (New York: John Wiley and Sons, 2002).
- ¹⁴ Richard LeGates and Erika Lew reviewed websites of 73 programs from the ACSP *Guide to Graduate Education in Planning 11th edition* (2000) and the UAA, *Directory of Programs in Urban Studies and Urban Affairs* (1995). We visited the websites of one graduate planning program in each state that had at least one such program, all California graduate planning programs, and a range of undergraduate urban planning, undergraduate urban studies, and graduate urban studies programs in different states.

- ¹⁵ USP 192. GIS for Urban and Community Planning
Introduction to Geographic Information Systems and using GIS to make decisions: acquiring data and organizing data in useful formats; demographic mapping; geocoding. Selected exercises examine crime data, political campaigns, banking and environmental planning, patterns of bank lending and finance. Prerequisite: upper-division standing.
- ¹⁶ USP 193L. San Diego Community Research Lab
Using the San Diego region as a case study, students will be introduced to the process of collecting, evaluating, and presenting urban and regional data using GIS mapping. Prerequisite: upper-division standing, consent of instructor, and completion of USP 193.
- ¹⁷ The bulletin description of the Clemson courses are:
CRP 803 Quantitative Analysis [Fall term]
This introductory graduate quantitative analysis course aims to give students a solid foundation in applications of basic statistical and spatial techniques as applied in contemporary urban planning and policy analysis. The course will help planners develop problem formulation, critical analysis, data analysis, and quantitative policy evaluation. The course will teach analysis, synthesis, and communication (oral, graphic, and written) skills while providing students with a basic understanding of methods of planning analysis. Course content focuses students on developing an understanding of operational planning techniques, data used in planning applications, and the use of data analysis tools and geographic information systems (GIS) and
CRP 804 Land Use [Spring term]
This course continues the objectives of CRP 803 which introduced a set of concepts and tools that are used in the practice of City and Regional Planning. The focus is developing an understanding of operational planning techniques, and data used in planning applications as well as the use of Geographic Information Systems (GIS). This course is structured to introduce planning methods in the context of analytical, procedural, and institutional needs of the planner. Urban Land Use Planning provides the structure and procedures with which GIS technology and techniques are meshed. To support this work, students will learn and apply planning methods to planning data sets in developing a land suitability analysis and a land use plan design.
- ¹⁸ The courses are: CRP 830 “Introduction to GIS”, CRP 834 “Spatial Modeling Using GIS”, and CRP 835 “GIS & Remote Sensing Applications for Trend Analysis”.
- ¹⁹ NSF Division of Undergraduate Education (DUE) Course, Curriculum, and Laboratory Improvement Educational Materials Development (CCLI-EMD) grant DUE 0228878 “Space Culture and Urban Policy”. The project website is <http://bss.sfsu.edu/nsfgis/index.htm>.

Appendix A: Undergraduate U.S. Urban Studies and Urban Affairs Program enrollments from the Urban Affairs Association *Directory of Programs in Urban Studies and Urban Affairs* (1995).

Name	City/State	Program/Degree Title	1995 Enrollment
Urban Studies Program Enrollments (1995)			
UC, San Diego	La Jolla, CA	Urban Studies & Planning	200
Cleveland State Univ.	Cleveland, OH	Urban Studies	125
Univ. of Dist. of Columbia	Washington, D.C.	Urban Studies	120
Worcester State College	Worcester, MA	Urban Studies	100
Univ. of Pennsylvania	Philadelphia, PA	Urban Studies	80
Northwestern Univ.	Evanston, IL	Urban Studies	60
Univ. of Wisconsin, Green Bay	Green Bay, WI	Urban & Regional Studies	60
Univ. of Minnesota, Twin Cities	Minneapolis, MN	Urban Studies	50
Rutgers (New Brunswick)	New Brunswick, NJ	Urban Studies	50
Stanford University	Stanford, CA	Urban Studies	45
CSU, Northridge	Northridge, CA	Urban Studies	40
University of Cincinnati	Cincinnati, OH	Urban Studies	35
Jackson State Univ.	Jackson, MS	Urban Studies	30
Shippensburg Univ. of Pennsylvania	Shippensburg, PA	Urban Rural Studies	28
Brown University	Providence, RI	Urban Studies	26
Elmhurst College	Elmhurst, IL	Urban Studies	25
Hampshire College	Amherst, MA	Urban Studies	25
Furman University	Greenville, SC	Urban Studies	25
Univ. of Tennessee, Knoxville	Knoxville TN	Urban Studies	25
Canisius College	Buffalo, NY	Urban Studies	24
Hunter College of CUNY	New York, NY	Urban Studies	24
Vassar College	Poughkeepsie, NY	Urban Studies	21
Metro. State College of Denver	Denver, CO	Urban Studies	20
DePaul University	Chicago, IL	Urban Studies	20
Boston University	Boston, MA	Urban Studies & Public Policy	20
Rutgers (Camden)	Camden, NJ	Urban Studies & Community Planning	20
Fordham University	Bronx, NY	Urban Studies	20

Name	City/State	Program/Degree Title	1995 Enrollment
College of Charleston	Charleston, SC	Urban Studies	20
Univ. of Wisconsin, Oshkosh	Oshkosh, WI	Urban & Regional Studies	20
Univ. of Minnesota, Duluth	Duluth, MN	Urban & Regional Studies	19
Dillard University	New Orleans, LA	Urban Studies & Public Policy	15
Macalester College	St. Paul, MN	Urban Studies	14
Univ. of Nebraska, Omaha	Omaha, NE	Urban Studies	12
Univ. Conn., Storrs	Storrs, CT	Urban Studies	10
Saint Peter's College	Jersey City, NJ	Urban Studies	10
Lehigh University	Bethlehem, PA	Urban Studies	10
Rhode Island College	Providence, RI	Urban Studies	10
St. Olaf College	Northfield, MN	Urban Studies	9
Merrimack College	Lawrence, MA	Urban Studies	8
Columbia University	New York, NY	Urban Studies	8
Trinity University	San Antonio, TX	Urban Studies	8
Univ. Conn., Hartford	West Hartford, CT	Urban Studies	6
Wittenberg University	Springfield, OH	Urban Studies	5
William-Smith College	Geneva, NY	Urban Studies	4
Ohio Wesleyan Univ.	Delaware, OH	Urban Studies	4
University of Tampa	Tampa, FL	Urban Studies	3
Central College	Pella, IA	Urban Studies	3
Rockford College	Rockford, IL	Urban Studies	1
Thomas Edison State College	Trenton, NJ	Urban Studies	--
College of Wooster	Wooster, OH	Urban Studies	--
Total Urban Studies Program Enrollments (1995)			1,517

Name	City/State	Program/Degree Title	1995 Enrollment
Urban Affairs Program Enrollments (1995)			
Indiana Univ., Bloomington	Bloomington, IN	Public Affairs	798
George Mason University	Fairfax, VA	Urban Systems Engineering	100
Wright State Univ.	Dayton, OH	Urban Affairs	65
St. Cloud University	St. Cloud, MN	Local & Urban Affairs	57
New York University	New York, NY	Metropolitan Studies	53
Western Washington University	Bellingham, WA	Urban Planning & Environmental Policy	50
Bryn Mawr College	Bryn Mawr, PA	Growth & Structure of Cities	49
Occidental College	Los Angeles, CA	Public Policy	37
Indiana University—Northwest	Gary, IN	Public Affairs	12
Univ. of Rhode Island	Kingston, RI	Urban Affairs	12
Connecticut College	New London, CT	Urban Affairs	8
Augsburg College	Minneapolis, MN	Metropolitan Studies	8
Saint Louis Univ.	St. Louis, MO	Urban Affairs	3
Roosevelt University	Chicago, IL	Metropolitan Studies	--
Total Urban Affairs Program Enrollments (1995)			1,252
Total Urban Studies and Urban Affairs Program Enrollments (1995)			2,769

Appendix B: Urban Planning Programs in the Association of Collegiate Schools of Planning *Guide to Graduate and Undergraduate Urban Planning Education, 11th edition (2000).*

Alabama A & M University	San Jose State University
Appalachian State University	Southwest Missouri State University
Arizona State University	State University of New York at Albany
Auburn University	State University of New York at Buffalo
Ball State University	Tehnon-Israel Institute of Technology
Buffalo State College	Texas A&M University
California Polytechnic State University, San Luis Obispo	Université de Montréal
California Polytechnic State University, Pomona	University of Akron
Clemson University	University of Arizona
Cleveland State University	University of British Columbia
Columbia University	University of Calgary
Cornell University	University of California, Berkeley
Dalhousie Tech	University of California, Irvine
East Carolina University	University of California, Los Angeles
Eastern Washington University	University of Cincinnati
Florida Atlantic University	University of Colorado at Denver
Florida State University	University of Delaware
Georgia Institute of Technology	University of Florida
Georgia State University	University of Guelph
Harvard University	University of Hawaii at Manoa
Hunter College of the City University of New York	University of Chicago
Indiana University of Pennsylvania	University of Urbana-Champaign
Indiana University – Purdue University in Indianapolis	University of Iowa
Iowa State University	University of Kansas
Jackson State University	University of Liverpool
Kansas State University	University of Louisville
Massachusetts Institute of Technology	University of Manitoba
McGill University	University of Maryland, College Park
Miami University	University of Massachusetts, Amherst
Michigan State University	University of Massachusetts, Lowell
Minnesota State University, Mankato	University of Memphis
Morgan State University	University of Michigan
New School University	University of Minnesota
New York University	University of Nebraska – Lincoln
Northern Arizona University	University of New Mexico
Ohio State University	University of New Orleans
Portland State University	University of North Carolina
Pratt Institute	University of Oklahoma
Queens University	University of Oregon
Queensland University of Technology	University of Pennsylvania
Saint Louis University	University of Rhode Island
San Diego State University	University of Saskatchewan

University of Southern California
University of Southern Maine
University of Tennessee
University of Texas, Arlington
University of Texas, Austin
University of Toledo
University of Toronto
University of Utah
University of Virginia
University of Washington
University of Windsor
University of Wisconsin, Madison
University of Wisconsin, Milwaukee
Virginia Commonwealth University
Virginia Polytechnic Institute and State University
Wayne State University
York University

Appendix C: Enrollments in PAB-accredited undergraduate urban planning programs in 1998/1999 from the Association of Collegiate Schools of Planning *Guide to Graduate and Undergraduate Urban Planning Education, 11th edition (2000)*.

Name	City/State	Program/Degree Title	1998/1999 Enrollment
University of Cincinnati	Cincinnati, OH	Urban Planning	129
Iowa State University	Ames, IA	Community and Regional Planning	123
University of Illinois	Champaign, IL	Urban and Regional Planning	116
Ball State University	Muncie, IN	Urban Planning and Development	66
Cal Poly, Pomona	Pomona, CA	Urban and Regional Planning	55
Cal Poly, SLO	San Luis Obispo, CA	City and Regional Planning	35
Michigan State University	East Lansing, MI	Urban and Regional Planning	35
Eastern Washington University	Spokane, WA	Urban and Regional Planning	17
University of Virginia	Charlottesville, VA	Urban and Environmental Planning	10
Alabama A & M University	Normal, AL	Community Planning and Urban Studies	8
Total			594

Appendix D: Enrollments in unaccredited undergraduate urban planning programs in 1998/1999 from the *Association of Collegiate Schools of Planning Guide to Graduate and Undergraduate Urban Planning Education, 11th edition (2000).**

Name	City/State	Program/Degree Title	1998/1999 Enrollment
Appalachian State University	Boone, NC	Community and Regional Planning	21
Arizona State University	Tempe, AZ	Planning	20
Buffalo State College	Buffalo, NY	Urban Regional Analysis and Planning	39
Cornell University	Ithaca, NY	Urban Studies	27
East Carolina University	Greenville, NC	Urban and Regional Planning	32
Florida Atlantic University	Fort Lauderdale, FL	Urban and Regional Planning	9
Georgia State University	Atlanta, GA	Urban Policy Studies	49
Indiana University of Pennsylvania	Indiana, PA	Regional Planning	16**
MIT	Cambridge, MA	Planning	13
Miami University	Oxford, OH	Urban and Regional Planning	6
Minnesota State University, Mankato	Mankato, MN	Urban and Regional Studies	18
Northern Arizona University	Flagstaff, AZ	Public Planning	69
Portland State University	Portland, OR	Community Development	22
Southwest Missouri State University	Springfield, MO	Community and Regional Planning	21
SUNY, Albany	Albany, NY	Urban Studies and Planning	24
SUNY, Buffalo	Buffalo, NY	Environmental Design	37
UC Irvine	Irvine, CA	Environmental Analysis and Design	17
University of Colorado, Denver	Denver, CO	Environmental Design	35
USC	Los Angeles, CA	Planning and Development	33
University of Toledo	Toledo, OH	Geography and Planning	32
University of Utah	Salt Lake City, UT	Urban Planning	32
University of Washington	Seattle, WA	Community and Environmental Planning	36

Name	City/State	Program/Degree Title	1998/1999 Enrollment
Virginia Commonwealth University***	Richmond, VA	--	--
Virginia Polytechnic Institute	Blacksburg, VA	Public and Urban Affairs	19
Virginia Polytechnic Institute	Blacksburg, VA	Environmental Policy and Planning	18
Total			645

Source: Association of Collegiate Schools of Planning, Guide to Undergraduate and Graduate Education in Urban and Regional Planning (2000)

*Twelve of these programs are also included in the table of Urban Studies/Affairs undergraduate programs in the U.S. based on the UAA directory.

**Degrees granted from 9/1//98 to 8/31/99 (1998-1999 student enrollment not provided)

***ACSP Guide indicates that an undergraduate program exists, but provides no information about the program. The total enrollment of overlapping programs, based on the 1998-1999 enrollement figures provided above, is 291 students.

Appendix E: Planning faculty with specializations in GIS, computer applications, and/or quantitative methods from the Association of Collegiate Schools of Planning *Guide to Graduate and Undergraduate Urban Planning Education, 11th edition (2000).*

	Geographic Information Systems	Computer Applications	Quantitative Methods
Aberley, Douglas	x		
Accordino, John J.		x	
Adams, John S.			x
Ahern, Jack	x		
Alberti, Marina	x	x	x
Alcantra, Adelmarr			x
Alhadeff, Jack	x	x	
Al-Kodmany, Kheir	x	x	x
Amir, Shaul		x	
Arias, Ernesto		x	
Armstrong, Helen			x
Aryeetey-Attoh, Samuel	x	x	
Assaad, Ragui A.			x
Audirac, Ivonne			x
Azis, Iwan			x
Bae, Christine			x
Bailey, Timothy J.			x
Bainbridge, Robert		x	
Bame, Sherry	x	x	x
Banai, Reza			x
Barreto, Felix R.	x	x	x
Barrett, Edith			x
Basolo, Victoria			x
Begg, Robert B.	x		
Bejleri, Ilir	x	x	x
Bell, Earl	x	x	x
Bell, Philip	x		
Benhart, Jr., John E.	x		
Bis, John S.		x	
Blakely, Edward			x
Bohland, James	x		x
Boisvert, Michel			x
Borich, Timothy O.			x
Bossard, Earl G.	x	x	x
Bosselmann, Peter		x	x
Bourassa, Steven C.			x
Bowen, William			x

	Geographic Information Systems	Computer Applications	Quantitative Methods
Brooks, Arthur			x
Brooks, Kenneth	x		
Brooks, Kerry	x	x	x
Brown, David F.	x	x	x
Burke, Aaron E.	x	x	
Burne, Alan M.	x	x	
Burton, Scott	x		
Buzer, Sue	x	x	
Campbell, Scott D.			x
Cantarero, Rodrigo	x	x	x
Carlson, Virginia			x
Cervero, Robert		x	x
Chapin, Tim	x		x
Charbonneau, Francois	x		
Chard, Richard			x
Chen, Alexander		x	
Chenoweth, Richard		x	
Cherrington-Cuore, Janet		x	
Choquette, Robert		x	
Clark, Thomas			x
Cole, Richard L.			x
Cole, Sam	x	x	x
Colgan, Charlie	x	x	x
Contant, Cheryl K.			x
Cook, John	x	x	
Cooksy, Leslie			x
Cordero-Guzman, Hector			x
Cote, Paul	x		
Crawford, Paul C.	x		
Crepeau, Richard		x	
Cummings, F. Harry			x
Czajkowski, Kevin P.	x	x	
Czamanski, Daniel			x
Dakan, William	x		x
Daly, Mike	x		
Danahy, John		x	
Daniere, Amrita			x
Davis, Jennifer			x
Deka, Derajyoti		x	x
Demonchaux, Joseph	x	x	
Dendrinis, Dimitrios		x	x
Deng, Yongheng		x	x

	Geographic Information Systems	Computer Applications	Quantitative Methods
Devoy, Joseph	x	x	
Deyle, Robert	x		
Dickey, John W.		x	x
DiFrancesco, Richard		x	
Ding, Chengri	x	x	x
Donaghy, Kieran P.			x
Dorcey, Anthony H.J.		x	
Drummond, William	x	x	x
Dubbink, David		x	
Dueker, Ken	x		
Edwards, Patricia K.			x
Elhami, Shoreh	x		
Ellis, David			x
Emmi, Philip C.			x
Esnard, Ann-Margaret	x	x	
Estrada, Leobardo	x		
Ewing, Gordon O.		x	x
Faust, Nick	x	x	
Feldman, Marchall M.			x
Finn, John	x		
Fisher, Austin	x		
Fitzgibbon, John	x		
Fitzsimons, John	x	x	x
Flachsbart, Peter G.			x
Forkenbrock, David			x
Foster, E. Michael			x
Freeman, Lance			x
French, Steven P.	x	x	x
Frothingham, Kelly	x	x	
Gaber, Sharon			x
George, R. Varkki		x	
Ghobrial, Alef		x	
Gill, Daniel		x	
Giuliano, Genevieve	x	x	
Gomez-Ibanez, Jose			x
Gooding, Earl N.M.			x
Gordon, David L.A.		x	
Gordon, Peter			x
Gordon, Steven I.	x	x	
Grabow, Stephen	x		
Gross, Mark		x	
Gross, Meir	x		x

	Geographic Information Systems	Computer Applications	Quantitative Methods
Guenet, Michel	x	x	
Guhathakurta, Subhrajit	x	x	x
Guldmann, Jean-Michel			x
Hale, Thomas A.	x		
Hanley, Paul		x	
Hawley, R. Dawn		x	
Heath, Terri			x
Heikkila, Eric	x	x	x
Henderson, Floyd	x		
Henry, Gary			x
Hewings, Geoffrey	x		
Hibbard, Judy			x
Higgs, Gary	x	x	
Hill, William W.			x
Hissong, Rodney V.			x
Holmes, Ann			x
Hopkins, Lewis D.	x	x	
Hotchkiss, Charles			x
Howard, Daniel	x	x	
Huddleston, Jack R.			x
Huntoon, Laura			x
Hurand, Fred		x	x
Huxhold, William	x		
Irvine, Kim			x
Isard, Walter			x
Isserman, Andrew		x	x
Izeogu, Chukudi			x
Jackson-Smith, Douglas	x		x
Jansen, Anicca C.		x	
John Kim, Tschangho	x	x	
Johnston, Stephen J.	x	x	
Jojola, Theodore		x	
Juster, Robert			x
Jutla, Rajinder			x
Kahn, Terry D.			x
Kartez, Jack	x		
Kaufman, Sanda		x	x
Kawamura, Kazuya			x
Keithley, Claude A.		x	x
Kelley, William J.			x
Keys, Linda			x
Khattak, Asad			x

	Geographic Information Systems	Computer Applications	Quantitative Methods
Kim, Karl E.	x		x
King, Lew-Jean	x	x	
Klopper, Eric			x
Kosterman, Richard	x	x	x
Kotval, Zenia Z.			x
Kuhn, Sarah		x	
Lacey, Linda			x
Lagro, Jr., James A.	x		
Laloo, Kiran	x	x	
Landis, John D.		x	x
Larsen, Larissa	x	x	
Latimer, Stanley	x	x	
Lawson, Catherine		x	
Lawson, Gillian		x	
Law-Yone, Hubert	x		
Lee, Joseph A.	x		
Lee, Moon Wha			x
Lee, Young-Jae		x	
Lee, Yuk		x	x
Levine, Jonathan C.	x		x
Levy, Richard M.	x	x	x
Lew, Alan A.	x	x	
Lewis, David B.			x
Lewis, Gregory			x
Lewis, Paul	x		
Li, Jianling	x	x	
Liggett, Robin	x	x	x
Lindquist, Peter S.	x	x	
Lloyd, Richard		x	
Lobo, Jose		x	
Loggins, Charles			x
London, Roseanne			x
Looye, Johanna W.			x
Lure, Jr., Thomas F.			x
Luther, Joseph	x		
MacDougall, E. Bruce	x	x	x
Mahayni, Riad G.			x
Man, Joyce			x
Mann, Shannon J.	x	x	
Marcouiller, David		x	x
Mathews, Joseph	x	x	x
Mattson, Gary A.			x

	Geographic Information Systems	Computer Applications	Quantitative Methods
Mayfield, Michael	x	x	
Mayo, James			x
McCall Jr., Raymond		x	
McClure, Kirk			x
McCormack, Arlene	x		x
McDaniels, Timothy		x	x
Mehretu, Assefa			x
Milczarski, William J.			x
Miles, Rebecca			x
Miller, Donald			x
Minoo, Amini S.	x		
Mogyorody, Veronika		x	
Monroe, Charles			x
Montagu, Simon A.	x	x	
Moore li, James		x	x
Morrell, James	x		
Morrow-Jones, Hazel			x
Moss, Philip			x
Motil, Brian		x	x
Moustafa, Amer		x	
Mower, James	x		
Muller, Brian	x	x	
Musacchio, Laura	x	x	
Mushkatel, Alvin			x
Mutunayagam, N. Brito	x	x	
Nedovic, Zorica	x		
Niemann, Jr., Bermard J.	x		
Nitz, Lawrence H.	x		x
Nocks, Barry			x
Novick, Paul	x	x	
Nwanko, Adiele	x	x	
Okuyama, Yasuhide			x
Olson, Judy M.			x
Ottensman, John	x	x	x
Page, G. William	x	x	x
Pamuk, Ayse			x
Paris, Jacques	x	x	x
Parker, Richard			x
Parker, Robert		x	x
Patton, Carl			x
Peiser, Richard			x
Pendall, Rolf			x

	Geographic Information Systems	Computer Applications	Quantitative Methods
Peng, Zhong-Ren	x		x
Perkinsan, Dennis			x
Perle, Eugene D.		x	x
Perlich, Pamela S.		x	x
Peters, Alan H.	x		
Phillips, David L.	x	x	x
Phillips, Rhonda			x
Phipps, Alan G.		x	x
Pigozzi, Bruce W.			x
Pijawka, David			x
Pipkin, John			x
Poister, Theodore			x
Pooler, James	x		x
Poulton, Michael			x
Prosperi, David C.	x	x	x
Pugh, David		x	
Putman, Stephen			x
Racca, David	x	x	
Radke, John D.	x	x	x
Rahm, Dianne		x	x
Ratledge, Edward		x	
Rea, Louis M.			x
Reed, Randal L.		x	
Reese, Laura	x		x
Renner, Donald E.			x
Rex, Arthur	x	x	
Richardson, Harry			x
Rogers, George			x
Roselle, Ann	x	x	
Rugg, Robert D.	x	x	x
Rutherford, Brent M.			x
Rutherford, G. Scott		x	
Ryznar, Rhonda	x		
Saka, Anthony A.	x	x	x
Salazar, Dayana		x	
Salling, Mark	x		
Saltzman, Sidney			x
Sanchez, Tom	x	x	x
Saphores, Jean-Daniel			x
Schneider, Richard	x	x	
Schoen, David A.	x	x	x
Schuster, J. Mark			x

	Geographic Information Systems	Computer Applications	Quantitative Methods
Seidel, Andrew		x	
Sharkova, Irina	x		
Shefer, Daniel			x
Shen, Guogiana	x		
Shen, Quing	x		x
Sheng, Grant		x	
Sherrill, Samuel		x	x
Shiffer, Michael	x	x	
Shinn, Duane	x		
Shoup, Donald			x
Shove, Christopher	x		
Siebert, Loren	x	x	
Silka, Linda	x		
Silverman, Robert			x
Silvers, Arthur L.			x
Simonsen, William			x
Sivitanidou, Rena			x
Skaburkis, Andrejs			x
Skelton, Ian			x
Skinner, James			x
Smith, Marc			x
Sorant, Peter	x	x	x
Soule, Peter			x
Spence, Edward	x	x	
Spraker, Larry	x		
Stanilov, Kiril		x	
Steeh, Charlotte			x
Steiner, Ruth	x	x	x
Stephens, Richard B.		x	
Stockard, Jean			x
Strathman, James			x
Streib, Gregory			x
Studer, Raymond		x	
Suen, I-Shian	x	x	x
Szabat, Kathleen			x
Taff, Samuel	x	x	
Tang, Tao	x	x	
Tengs, Tammy			x
Thakuriah, Piyushimita			x
Thompson, Gregory			x
Tilly, Chris			x
Tomlin, Dana	x		

	Geographic Information Systems	Computer Applications	Quantitative Methods
Torres, Deborah		x	
Trancik, Roger	x	x	
Urey, Gwendolyn H.			x
Verma, Niraj		x	x
Viton, Philip A.		x	x
Von Essen, Ian	x	x	
Von Winterfeldt, Detlof		x	x
Vos, Jaap			x
Waddell, Paul	x	x	x
Waldorf, Brigitte			x
Walker, Terry		x	
Wang, Xinhao	x	x	
Warren, Stacy	x	x	
Weeks, Edward		x	x
Westerlund, Frank	x	x	
Wildgen, John	x	x	x
Wilkinson, Paul			x
Wilson, Mark I.		x	
Winchell, Dick G.		x	x
Wright, Robert		x	
Wubneh, Mulata			x
Wyles, James C.	x		
Yanich, Danilo			x
Yilmaz, Umit		x	
Yin, Jordan	x		
Yonder, Ayse		x	x
Young, Cyrus W.	x	x	x
Young, James	x	x	
Zhang, Tingwei	x		
Zias, Dean	x	x	x
Zwick, Paul D.	x	x	x
Total	151	167	218

Appendix F: Urban studies and planning program websites examined for this paper.

School	Program
Alabama Agricultural and Mechanical University	BA, MS
Arizona State University	BS, MA
Augsburg College	BA
Ball State University	BA
Brown University	BA
Bryn Mawr College	BA
California Polytechnic State University, San Luis Obispo	BS, MA
California State Polytechnic University, Pomona	BS
California State University, Chico	MA
Clemson University	MA
Cleveland State University	BA, BS, MA
College of Charleston	BA
College of Wooster	BA
East Carolina University	BS
Eastern Michigan University	BS, MS
Elmhurst College	BA
Florida State University	MA
Fordham University – Rosehill Campus	BA
Georgia Institute of Technology	MA
Georgia State University	BA, MA
Jackson State University	BA, MA
Kansas State University	MA
Loyola Marymount	BA
Massachusetts Institute of Technology	BS, MA
Metropolitan State College of Denver	BA
Michigan State University	MA
Occidental College	BA
Portland State University	MA
Rutgers, The State University of New Jersey at Camden	BA
Saint Louis University	MA
San Diego State University	BA, MA
San Francisco State University	BA
San Jose State University	MA
Stanford University	BA
State University of New York at Buffalo	MS
Texas A & M University	MA

School	Program
University of Alabama, Tuscaloosa	BS
University of Arizona	BS, MA
University of California, Berkeley	BA, MA
University of California, Irvine	MA
University of California, Los Angeles	MA
University of California, Northridge	BA
University of California, San Diego	BA
University of Colorado at Denver	MA
University of Connecticut – Storrs	BA
University of Illinois at Urbana-Champaign	BA, MA
University of Iowa	MA
University of Louisville	MA
University of Maryland at College Park	MA
University of Minnesota	MA
University of Missouri, Kansas City	BA
University of Nebraska – Omaha	MS
University of Nebraska – Lincoln	MA
University of New Mexico	MA
University of New Orleans	MA
University of North Carolina at Chapel Hill	MA
University of Oklahoma	MA
University of Pennsylvania	MA
University of Rhode Island	MA
University of Southern California	BS, MA
University of Southern Maine	MA
University of Tampa	BA
University of Tennessee	BA, MA
University of Washington	BA, MA
University of Wisconsin – Green Bay	BA, BS
University of Wisconsin – Milwaukee	MA
Virginia Commonwealth University	MA
Washington State University	MA
Western Washington University	BA
Worcester State College	BS